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IDENTIFIERS	University of Miami FL

ABSTRACT

A major aim of this study was to determine if Attention Deficit Hyperactivity Disorder (ADHD) type behaviors observed at the age of 30 months in low birth weight children are predictive of ADHD and school difficulties at 5 and 8 years of age. Three major questions were addressed: (1) Do children who exhibit ADHD characteristics at 30 months differ from children without those characteristics with respect to initial status variables, cognition, parent report of problem behaviors and initial response to early intervention? (2) What is the relative contribution of ADHD symptomology observed at 30 months, parent reports of child behavior, and the home environment to prediction of child behavior problems at 5 and 8 years of age? (3) Are children who exhibit ADHD symptomology at 30 months more likely to receive special services at 5 and 8 years of age than children who did not exhibit these behaviors? In the study, 711 videotapes of mother-child interactions during 8 minutes of free play were coded for ADHD symtomotology. Factor scores derived from the ADHD Observational Rating Scale (ADHD-ORS) were used to predict two outcome variables, mother's report of physician diagnosis of ADHD and/or grade retention. Results indicate that ADHD-like behavior can be observed at this young age during interactions. The inattentiveness factor predicted both physician diagnosis and school difficulties. These findings support the ability of the ADHD-ORS to predict the likelihood of ADHD behaviors and suggest that the scale can be used as a screening tool to identify young children in need of further assessment. Earlier identification of children with ADHD can lead to greater understanding of child needs and the adoption of environmental, behavioral, and medical interventions to manage symptoms and facilitate learning. The project's management chart, a financial status report, and 10 examples of manuscripts and PowerPoint presentations of the project's findings are included. (SG)

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ED 463 594

Attention Deficit Hyperactivity Disorder Early Identification Research Project

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Attached Document: Final Project Report

Future Contact (Fewell retires 5/17/02): Ms. Barbara Deutscher
305 243 8008

EC 308865

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I.

FINANCIAL STATUS REPORT

(Follow instructions on the back.)

1. FEDERAL AGENCY AND ORGANIZATIONAL ELEMENT TO WHICH REPORT IS SUBMITTED	2. FEDERAL GRANT OR OTHER IDENTIFYING NUMBER	OMB Approved No. 80-R0180
Dept. of Health & Human Services, National Institutes of Health	H023C970231-02	

3. RECIPIENT ORGANIZATION (Name and complete address, including ZIP code)	4. EMPLOYER IDENTIFICATION NUMBER
UNIVERSITY OF MIAMI SPONSORED PROGRAMS P.O. BOX 025405 MIAMI, FL 33102-5405	59-0624458
	5. RECIPIENT ACCOUNT NUMBER OR IDENTIFYING NO. FR669581-2
	6. FINAL REPORT YES NO
	7. BASIS ☐ CASH ACCURAL

8. PROJECT/GRANT PERIOD (See instructions)		PERIOD COVERED BY THIS REPORT	
FROM (Month, day, year)	TO (Month, day, year)	FROM (Month, day, year)	TO (Month, day, year)
9/1/97	8/31/00	9/1/98	8/31/00

10. STATUS OF FUNDS	
a. Net outlays previously reported	$159,048.17
b. Total outlays this period	185,574.83
c. Less: Program income credits	0.00
d. Net outlays this report period (Line b minus line c)	185,574.83
e. Net outlays to date (Line a plus line d)	344,623.00
f. Less: Non-Federal share of outlays	0.00
g. Total Federal share of outlays (Line e minus line f)	344,623.00
h. Total unliquidated obligations	0.00
i. Less: Non-Federal share of unliquidated obligations shown on line h	0.00
j. Federal share of unliquidated obligations (Line h minus line i)	0.00
k. Total Federal share of outlays and unliquidated obligations (Line g plus j)	344,623.00
l. Total cumulative amount of Federal funds authorized	346,890.00
m. Unobligated balance of Federal funds (Line l minus like k)	2,267.00

11. INDIRECT EXPENSE	a. TYPE OF RATE (Place "X" in appropriate box)	PROVISIONAL	PREDETERMINED	FINAL	FIXED
	b. RATE	c. BASE	d. TOTAL AMOUNT		e. FEDERAL SHARE
	52.0% MTDC	122,088.71	63,486.12		63,486.12
	50.0% MTDC	0.00	0.00		0.00
	TOTAL	122,088.71	63,486.12		63,486.12

12. REMARKS (Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation.)

THIS AMOUNT INCLUDES 1,131.00 REST. FROM YR 1 AND 1,136.00 REST. YR 2

13. CERTIFICATION	SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL	DATE REPORT SUBMITTED
I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award documents		11/27/00
	TYPED OR PRINTED NAME AND TITLE ANA ROSA VALERA GRANTS SECTION	TELEPHONE (Area code, number, and extension) (305)243-4493

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II. PROJECT SUMMARY

The Attention Deficit Hyperactivity Disorder (ADHD) Early Identification Research Project was designed to answer questions about the early onset of this difficult to diagnose syndrome. The goal of this research project was to determine if certain behaviors observed in children under three years of age are predictive of ADHD behaviors at five and eight years of age. We investigated the presence of observed ADHD type behaviors in low birth weight children, a population at high risk for this diagnosis. Three major questions were addressed: 1) Do children who exhibit ADHD characteristics at 30 months differ from children without those characteristics with respect to initial status variables, cognition, parent report of problem behaviors and initial response to early intervention? 2) What is the relative contribution of ADHD symptomology observed at 30 months, parent reports of child behavior, and the home environment to prediction of child behavior problems at 5 and 8 years of age? 3) Are children who exhibit ADHD symptomology at 30 months more likely to receive special services at 5 and 8 years of age than children who did not exhibit these behaviors. We soon realized that maternal interactions and general information as to treatment strategies were the kinds of information the field sought from us with regard to this project and we began to consider these topics as well.

The project involved the coding of 711 mother-child interactions videotaped when the children were 30 months old. We then integrated this new observational data with the archived database of longitudinal data collected as part of the Infant Health and Development Program (IHDP). Group comparisons, multiple regressions and discriminant function analyses were used to answer the proposed questions. In addition, the link to the important IHDP study enabled us to determine whether early intervention did have an impact on the behavior of very young children. Moreover, we identified behaviors predictive of ADHD symptoms at a very early age

which would mean the possibility of earlier intervention before the negative impact on cognitive, social and emotional development occurs.

III. PROJECT STATUS

As stated in our proposal, we have four components critical to the project evaluation—procedural evaluation, research monitoring evaluation, reliability evaluation and research outcome evaluation.

First, we use a management chart to monitor our progress on all objectives. Our management chart is a slight variation on the procedural objectives and timeline submitted and allowed us to monitor closely the timely meeting of all objectives and record actual outcomes. As can be seen on the enclosed Management Chart, project activities were accomplished (indicated by an *"AO"* representing "activity accomplished". We were given a no cost time extention of 12 months for this project and we needed these 12 months given the nature of the project. We originally had requested the project be funded for three years but it was only funded for two. Thus, we had to try to meet our objectives in a shorter time period. As can be seen from the many communications enclosed in the attachments of previous reports, we also ran into unexpected delays in getting the datasets and locating variables. This held up the process of transferring them to a working database so the analyses could begin. We also had some delays with the coding as we underestimated the amount of time it would take to train, view and code the videotapes. Not wanting to compromise the accuracy of the project, we took the necessary time to achieve high reliability so we can trust the findings. We have found it to be a more efficient use of time and resources to combine the ADHD and MCI analyses and not treat them separately as in our timeline. In the long run, this worked better especially for our statistician. We have been requested to present our findings at many professional conferences, we have two

manuscripts being released as this report is being prepared, two being submitted within the next week, and we anticipate several more manuscripts as well as conference presentations on our findings. Please see the attachments for examples of those items we have noted.

We have continued to meet together to discuss our findings and work on manuscripts related to this project. As noted on the manuscripts in press, we work closely together on these presentations in an ongoing manner.

Third, our stringent reliability standards and training efforts yielded results that ensure that our research is of the quality that can be trusted by the field. Please see the extensive data that was included in the previous report.

Fourth is our research outcome evaluation work continues as we respond to the reviews we receive on our submissions.

MANAGEMENT CHART

GOAL 1: TO ESTABLISH THE PROJECT AS A UNIVERSITY UNIT

OBJECTIVES	ACTIVITIES/METHODS	TARGET DATE	DATE ACCOM - PLISHED	EVALUATION/OUTCOME
1.1 To set up project administration	1.1.1 Process documents to set up project account in University	10/31/97	10/17/97	Account listed in the University computer *Objective Achieved (OA)*
	1.1.2 Obtain space agreement	09/30/97	09/22/97	Space agreement obtained *OA*
	1.1.3 Hire staff	01/30/98	11/4/97	Flyers announcing the coding positions were posted in the Education and Psychology Departments at the University of Miami. Six applicants responded and interviews were arranged and conducted. Coders with excellent backgrounds (master's and doctoral students) for the project were hired. *OA*
	1.1.4 Notify consultants/sites	09/30/97	9/12/97	Consultants and sites notified by letter. We notified 11 individuals and from this we have received requests from 2 investigators who have asked for additional data collection. This should result in a minimum of 3 additional studies from this single funded investigation. Costs for these studies will be absorbed without any additional cost to the project. *OA*
	1.1.5 Obtain supplies	12/30/97	12/30/97	Initial supplies ordered and received Ordering ongoing as needed. *OA*

GOAL 2: TO SET UP RESEARCH ADMINISTRATION

OBJECTIVES	ACTIVITIES/METHODS	TARGET DATE	DATE ACCOM-PLISHED	EVALUATION/OUTCOME
2.1 To set up research administration	2.1.1 Process documents for computer data access safeguards	11/30/97	11/25/97	Required safeguards are in place to prevent unwanted access to research data. A designated computer is in place with a password necessary to access files. Data is secure. *OA*
2.2 To transfer IHDP data tapes to project computer	2.2.1 Obtain data tapes from storage	11/30/97	11/10/97	Previous data tapes have been reorganized by site and are readily accessible. *OA*
2.3 To prepare flat files for data entry	2.3.1 Design and enter data base files for new data	12/30/97	12/19/97	Data entry preparations are in order for new data. *OA*
2.4 To train research coders for tapes (ADHD)	2.4.1 Prepare forms for coding	11/30/97	11/7/97	Forms prepared for coding *OA*
	2.4.2 Identify tapes for training	11/15/97	11/14/97	Training tapes identified. It was decided to use the twin videotapes for the purpose of training. The rationale for this decision is that twins were treated equally in the IHDP, but only one of the twins was a research subject so the training tapes could be the same as the actual study tapes but our number would not be compromised. *OA*
	2.4.3 Conduct training	12/30/97	01/30/98	Coder training was proceeding on schedule until one of the coders quit and we had to go through the process of hiring and training another coder to replace her. This has been accomplished but it set us back a month. *OA*
	2.4.4 Conduct reliability	12/30/97	2/20/98	Reliability was conducted for all the training tapes which were rated separately and then discussed until consensus was reached. After that training period, 25 additional tapes were rated by each coder and reliability computed. Coders are now reliable. *OA*

2.5 To train research coders for tapes (MCI)	2.5.1 Prepare forms for coding	1/31/98	1/21/98	Forms prepared for coding. Although this is not part of the contractual agreement, we indicated this addition on 11/17/97 when revisions had to be made to the grant because of the third year cutback. As mentioned, this presents no change to the budget. *OA*
	2.5.2 Identify tapes for training	2/28/98	2/2/98	A representative sample of training tapes have been identified as previously explained. *OA*
	2.5.3 Conduct training	4/30/98	3/25/98	Coders are trained. Reliability has been computed for the training tapes and coders are reliable. *OA*
	2.5.4 Conduct reliability	4/30/98	4/20/98	The 25 separate reliability tapes were rated by each coder and reliability computed. Coders are now reliable. *OA*

GOAL 3: TO GATHER RESEARCH DATA

OBJECTIVES	ACTIVITIES/METHODS	TARGET DATE	DATE ACCOM-PLISHED	EVALUATION/OUTCOME
3.1 To collect all research data (ADHD Scale)	3.1.1 Randomly assign tapes to coders	1/30/98	1/28/98	Tapes have been randomly assigned for us at Stanford University by one of our consultants, Donna Spiker. Also taken into account was whether the subjects were in the intervention or follow-up group. 15% reliability assignments were also made. Tapes can be coded *OA*
	3.1.2 Code tapes	05/31/98	9/14/98	Tapes from all 8 sites have been coded. The actual time it took was longer than anticipated. This was due to vacations, finals, illnesses and additional coding of the child's expressive language and the overlap for the project coordinator with the MCI training and coding *OA*
	3.1.3 Conduct drift reliability	05/31/98	9/14/98	Drift reliability was assessed as each site was completed to be certain all coders were meeting reliability standards. Reliability data is available and is above the preset research standards for analysis *(See Attachment in Previous Report) OA*
3.2 To enter tape data into base	3.2.1 Enter data in base	06/30/98	9/30/98	Data entered and ready for cleaning and analysis *OA*

	3.2.2 Conduct data cleaning	06/30/98	10/15/98	Data cleaning completed; data ready for analysis *OA*
3.3 To collect all research data (MCI Scale)	3.3.1 Randomly assign tapes to coders	04/30/98	4/20/98	Tapes have been randomly assigned for us at Stanford University by one of our consultants, Donna Spiker. Also taken into account was whether the subjects were in the intervention or follow-up group. 15% reliability assignments were also made. Tapes can be coded. *OA*
	3.3.2 Code tapes	08/31/98	10/14/98	Tapes from all 8 sites have been coded. The actual time it took was longer than anticipated. This was due to final exams, summer vacations, and illnesses of the coders *OA*
	3.3.3 Conduct drift reliability	08/31/98	10/14/98	Drift reliability was assessed as each site was completed to be certain all coders were meeting reliability standards. Reliability data is available and is above the preset research standards for analysis *(See Attachment in Previous Report) OA*
3.4 To enter tape data into base	3.4.1 Enter data in base	09/30/98	10/30/98	All data collected has been entered into the database and is ready for cleaning and analysis *OA*
	3.4.2 Conduct data cleaning	10/31/98	11/23/98	Data cleaning completed; data ready for analysis *OA*

GOAL 4: TO CONDUCT DATA ANALYSIS

OBJECTIVES	ACTIVITIES/METHODS	TARGET DATE	DATE ACCOM-PLISHED	EVALUATION/OUTCOME
4.1 To review data analysis plans for tapes(ADHD)	4.1.1 Grant reviewed for plans for tape analyses	08/31/98	8/10/98	Consultant meeting held -- plans discussed and suggestions offered so decisions can be made based on input from consultants *OA*
	4.1.2 Consultants used for input on preferred procedures	08/31/98	8/10/98	Expert opinion provided prior to analyses *OA*
4.2 Conduct analyses	4.2.1 Power analyses determined	08/31/98	1/31/99	Analyses determined which have the power needed to produce results *OA*
	4.2.2 Tape data analyzed for specified questions	09/30/98	8/31/00	Proposed questions are being answered *OA*

	4.2.3 Staff decides if additional analyses needed	08/31/98	8/31/00	All staff have first hand knowledge of findings and participate in suggesting additional analyses *OA As we reviewed analyses completed we determined that additional analyses were needed. This required several time extensions to accomplish this objective. Still continuing*
4.3 Results prepared for reports and dissemination	4.3.1 Results reviewed by investigators	09/30/98	8/31/00	All staff have first hand knowledge of findings *OA*
	4.3.2 Consultants critique findings	10/31/98	8/31/00	Information is provided to experts for their opinions *OA*
	4.3.3 Drafts of summaries for reports discussed	12/31/98	8/31/00	All staff have first hand knowledge of findings and participate in suggesting additional anal;yses *OA*
4. 4 To review data analysis plans for tapes (MCI)	4.4.1 Grant reviewed for plans for tape analysis	11/30/98	6/30/00	Consultant meeting held -- plans discussed and suggestions offered so decisions can be made based on input from consultants *OA*
	4.4.2 Consultants used for input on preferred procedures	11/30/98	7/31/00	Expert opinion provided prior to analyses *OA*
4.5 Conduct analyses	4.5.1 Power analyses determined	11/30/98	8/31/00	Analyses determined which have the power needed to produce results *OA*
	4.5.2 Tape data analyzed to answer specified questions	1/30/99	8/31/00	Proposed questions are being answered. We have available but not ready for discussion correlations of video tape sample versus non-taped sample, factor analyses of the ADHD scale, concurrent analyses with the CBCL at 24 and 36 months, t scores of the Home, etc. *OA*
	4.5.3 Staff decides if additional analyses needed	01/30/99	8/31/00	All staff have first hand knowledge of findings and participate in suggesting additional analyses *OA*
	4..5.4 Results reviewed by investigators	01/31/99	8/31/00	All staff have first hand knowledge of findings *OA*
	4.5.5 Consultants critique findings	03/30/99	8/31/00	Information is provided to experts for their opinions *OA*
4.6 Results prepared for reports and dissemination	4.6.1 Drafts of summaries for reports discussed	05/31/99	8/31/00	All staff have first hand knowledge of findings *OA*
	4.6.2 Finalized versions of reports prepared	06/30/99	8/31/00	Agency feels Project has produced the desired results *OA*
	4.6.3 Drafts of summaries of research discussed	07/31/99	8/31/00	Staff report and understanding of findings is shared by all *OA*
	4.6.4 Finalized versions of research prepared	08/31/99	8/31/00	United support produces stronger outcomes *OA*

GOAL 5: TO DISSEMINATE PROJECT REPORTS AND FINDINGS

OBJECTIVES	ACTIVITIES/METHODS	TARGET DATE	DATE ACCOM-PLISHED	EVALUATION/OUTCOME
5.1 To submit required progress reports	5.1.1 Draft required reports and circulate to staff	8/31/99	12/14/01	Reports ready for submission *OA*
	5.1.2 Submit required reports	8/31/99	12/31/01	Timely reports build confidence in staff *OA*
5.2 To prepare findings for multiple submissions	5.2.1 Obtain applications for conferences and journals	6/30/99	1/31/00	Staff preparing for national dissemination *OA (This is continuing) See attachments*
	5.2.2 Draft findings for multiple audiences	8/31/99	3/31/00	Findings are more sensitive to audiences *OA (This is continuing)*
	5.2.3 Share drafts among staff and with consultants	8/31/99	3/31/00	Consultant input produces improved presentations *OA (This is continuing)*
	5.2.4 Revise based on feedback	8/31/99	5/31/00	Staff produces stronger products *OA (This is continuing)*
5.3. To disseminate findings at professional meetings	5.3.1 Provide posters, presentations at conferences	8/31/99	6/30/99	Information able to be used by many groups *OA (Multiple presentations have been made and are continuing)*
	5.3.2 Provide handouts of findings at conferences	8/31/99	6/30/99	Participants share findings and information about project *OA See attachments*
5.4 To disseminate findings through print materials	5.4.1 Submit quality manuscripts to appropriate journals such as JEL, TOPICS, EC , JSE	8/31/99	3/20/00	Investment pays off as findings shared by those likely to use results *OA See attachments. We are continuing to submit manuscripts*
5.5 To disseminate findings to lay audiences	5.5.1 Present to local and national radio and TV shows	8/31/99	8/31/00	Public audiences benefit from research findings *Presentations made to CNN*

Early Predictors of Attention-Deficit/Hyperactivity Disorder (ADHD) and School Difficulties

Sponsored by U.S. Department of Special Education Grant # H023C97023

Rebecca R Fewell, Barbara Deutscher, James D McKinney, Donna Spiker, & Mary Percival

Abstract

A major aim of this study was to determine if ADHD type behaviors observed at age 2½ in low birthweight children are predictive of ADHD and school difficulties at age 8. Videotapes of mother-child interactions, during eight minutes of free play, were coded for ADHD symptomotology. Factor scores derived from the ADHD observational scale were used to predict two outcome variables, mother's report of physician diagnosis of ADD and/or hyperactivity, and mother's report of special education placement and/or grade retention. Resultsindicate ADHD like behavior can be observed at this young age during interactions. The inattentiveness factor predicted both physician diagnosis and school difficulties.

Introduction

- ADHD is the most common neuro-behavioral disorder of childhood, affecting children from early childhood through school and into their adult life
- 3% - 5% of school-aged children have significant educational problems because of ADHD. However, little is known about the onset of this difficult to diagnose syndrome
- Past studies have focused on school-aged children with ADHD, the comorbidity of ADHD with other disorders, and treatment medications. Little research has been done with toddlers and preschoolers

Method

Background, Procedure

IHDP study

- Subjects for this study were part of a larger study of low birth-weight premature infants, the Infant Health and Development Program (IHDP)
- IHDP was an 8 site, 3 year early intervention program with 995 subjects randomly assigned to intervention and follow-up groups
- Data were collected at ages 5, 6.5 and 8

Videotaping procedure

- Parents who consented were videotaped with their children at 2½ years of age using a standardized protocol
- Mothers were instructed to play with their children as if they had set aside a time just for them. Age appropriate toys were available throughout the 8 minute free play session that was the focus of interest for this study

Method

Subjects (N=702)

- Videotaped subset from original IHDP study
  Arkansas (n=112) Einstein (n=108) Harvard (n=92)
  Miami (n=65) Penn (n=54) Texas (n=105)
  Wash (n=99) Yale (n=67)
- Intervention (n=273) Follow-up (n=429)
- Mean birth-weight =1804 grams
- 51.0% male
- Ethnicity =38% White, 51% African American,
- 11% Other

Method

Measures

- ***Attention Deficit Hyperactivity Disorder -Observational Rating Scale.*** ADHD-ORS (Deutscher & Fewell, 1996) This 12 item scale was designed for use in this study. A 1-5 likert scale was used to code items. Two coders were trained by one of the scale developers. Interrater reliability within one for the 702 videotapes averaged 99%. Exact reliability averaged 89% across the 8 sites.
- ***Physician diagnosis*** This variable was created from maternal response to 2 questions at the age 8 interview-the physician reporting the child had ADD and/or the child was hyperactive.
- ***School difficulties*** This variable was created from maternal response to 2 questions at the age 8 interview-whether the child was classified as needing special education and/or whether the child had repeated a grade.

Method

Data Analysis

- Previously completed promax factor analysis identified 3 factors: inattentiveness, impulsivity and overactivity. (See Table 1)
- Preliminary analyses examined sex, birthweight and group assignment differences on the three factors
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and physician diagnosis at age 8
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and school difficulties at age 8.

Table 1: **FACTOR ANALYSIS**
ADHD-ORS (Deutscher & Fewell, 1996)
Principal Components: PROMAX Rotation

	Factor 1 Inattentiveness	Factor 2 Impulsivity	Factor 3 Overactivity
Always on the go	.27	.11	**.60**
Moves fast	-.00	.32	**.62**
Restless, fidgets	-.05	-.14	**.97**
Easily excited	-.10	**.86**	.06
Can't wait	.28	.53	-.12
Changes activities	**.84**	.01	.06
Acts before thinking	**.66**	.07	.16
Bikats out	.00	**.82**	.00
Easily distracted	**.79**	.07	.02
Doesn't focus	**.72**	.04	-.07
Short attention span	**.91**	.03	-.09
Difficulty staying on task	**.86**	-.14	.08

Results

- Preliminary analyses indicated no sex, birth-weight or group assignment differences on the 3 ADHD factors
- Scores on one of the ADHD-ORS factors measured at 2½, inattentiveness, predicted physician diagnosis ($p < .05$). Children with higher scores on this factor were significantly more likely to have a physician diagnosis by age 8.
- Scores on the three factor model of the ADHD-ORS measured at age 2½ predicted children who had experienced school difficulties at age 8 ($p < .05$). However, only the inattentiveness factor was a significant contributor ($p = <.01$). Children with higher scores on inattentiveness were significantly more likely to have received special education services or have been retained by age 8.

Conclusions

- ADHD symptomotology can be identified by age 2½ through observations during an eight minute free play videotaped interaction of children with their mothers.
- High scores on the inattentiveness factor predict physician diagnosis of ADD and/or hyperactivity by age 8.
- High scores on the inattentiveness factor predict special education placement and/or grade retention by age 8.

Implications

- Results suggest that ADHD type behaviors can be identified before the age of three years
- Results support the ability of the ADHD-ORS to predict the likelihood of ADHD behaviors and suggest that the scale can be used as a screening tool to identify young children in need of further assessment.
- Earlier identification of children with ADHD can lead to greater understanding of child needs and the adoption of environmental, behavioral and medical interventions to manage symptoms and facilitate learning.

Early Identification of ADHD Symptomatology in Children Under the Age of Three and Later Prediction of ADD/ADHD and School Related Problems

Rebecca R. Fewell, Ph.D.
Barbara Deutscher, B.S.
University of Miami School of Medicine

Presented at the Florida One Goal Summer Conference, July 19, 2001

What is ADHD ?

- A persistent pattern of inattention and/or hyperactivity that is more frequent and severe than typically observed in children of the same age
- Symptoms must have been present since before age 7
- Symptoms must be present in at least two situations and are chronic in nature
- Symptoms interfere with developmentally appropriate
- Symptoms can not be accounted for by other disorders

What is the Cause of ADHD ?

- Between 30% and 50% of ADHD appears to be inherited.
- Deficient functioning in areas of the brain that involve response inhibition, attention, and sensitivity to rewards and punishment appear to characterize some children with ADHD.
- ADHD is NOT caused by brain injury or external factors like sugar ingestion.
- The manner in which parents raise their children is NOT thought to be a chief cause of ADHD.

Brain and Behavior

- It takes a "team" effort for a brain to work well. These processes must be orchestrated for learning to occur:
  - Being awake and alert
  - Being motivated
  - Being perceptive
  - Being attentive
  - Being adaptive
- If these processes or plasticity in the synapses are faulty, then learning will be muted or permanently blocked

Brain Research and Behavior

- Researchers have investigated what happens in the brain when mistakes are made ("blunder blips", "oops" and "impulse conflicts")
- Researchers have investigated to what extent impulses are automatic and how well children can control them
- Researchers have studied "stop" and "go" signals when they are competing in the brain

Brain, Behavior and ADHD

- Researchers have studied "stop and go" impulse control in children with ADHD
  - Children with ADHD were slower to respond to "stop" signals than typically developing children
- Intervention is needed
  - Ritalin is used to treat this condition
  - Cognitive/Behavioral strategies can be used effectively
  - In some situations, both are needed

How Common is ADHD ?

- ADHD occurs in approximately 3-5% of the school-age population
- ADHD is more common in boys than in girls 6:1 as compared to 3:1
- Many children are described as having this condition but have not been diagnosed
- ADHD often occurs along with other problems

What Other Problems Are Associated with ADHD ?

- Learning disabilities
- Perceptual-motor problems
- Low self-esteem
- Depression or temper problems
- Oppositional defiant or conduct disorders
- Poor peer relations
- Accidental injuries
- Family Stress

Are There Some Risk Factors for ADHD ?

- Genetic Risks
  - Family history of hyperactivity, conduct disorder, alcoholism, learning disorders
- Medical Risks
  - Pregnancy problems
  - Maternal use of drugs and alcohol
  - Head trauma
  - Chronic medical illness such as asthma

IHDP Study Background

- Subjects were part of a larger study of low birth-weight, premature infants, the Infant Health and Development Program (IHDP).
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Videotaping Procedure

- Parents were videotaped with their children at 2½ years of age using a standardized protocol.
- Mothers were instructed to play with their children as if they had set aside a time just for them.
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Subjects (N=702)

- Videotaped subset from original IHDP study
  Arkansas =112; Einstein =108; Harvard =92; Miami =65; Penn =54; Texas =105; Washington =99; Yale =67
- Intervention =273; Follow-up =429
- Mean birth-weight =1804 grams
- 51.0% male
- Ethnicity =38% White, 51% Afri. Amer., 11% Other

Aim

To determine if ADHD type behaviors observed at age 2½ in low birthweight, premature children are predictive of

- physician diagnosis of ADHD at age 8
- school difficulties at age 8.

ADHD Observational Rating Scale

- **Overactivity**
  - Always on the go
  - Moves fast
  - Restless, fidgets
  - Easily excited, talks excessively
- **Impulsivity**
  - Can't wait, frustrates easily
  - Changes activities
  - Acts before thinking, rushes, careless
  - Blurts out, interrupts, loud, noisy
- **Inattention**
  - Easily distracted
  - Doesn't focus to follow directions
  - Short attention span
  - Difficulty staying on task

Predictor Measure

- ***Attention Deficit Hyperactivity Disorder - Observational Rating Scale***, (ADHD-ORS) (Deutscher & Fewell, 1996)
- 12 items
- 1-5 likert scale
- Two coders trained
- Interrater reliability within one for 702 videotapes averaged 99%
- Exact reliability averaged 89% across the 8 sites.

Outcome Measures

- Maternal response to 4 questions at 8 year interview
- ***Physician diagnosis***
- the child had **ADD** and/or
- the child was **hyperactive.**
- ***School difficulties***
- child classified needing **special education** and/or
- child had **repeated a grade.**

Data Analysis

- Promax factor analysis identified 3 factors: inattentiveness, impulsivity and overactivity.
- Preliminary analyses examined sex, birthweight and group assignment differences on the three factors
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and physician diagnosis at age 8.
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and school difficulties at age 8.

Results

- Scores on one of the ADHD-ORS factors measured at 2½, **inattentiveness, predicted physician diagnosis** ($p < .05$). Children with higher scores on this factor were significantly more likely to have a physician diagnosis by age 8.
- Scores on the **three factor model** of the ADHD-ORS measured at age 2½ predicted children who had experienced **school difficulties** at age 8 ($p < .05$). However, only the **inattentiveness** factor was a significant contributor ($p < .01$). Children with higher scores on inattentiveness were significantly more likely to have received special education services or have been retained by age 8.

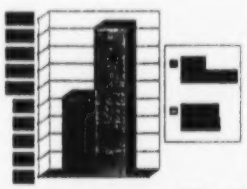
Items Loading on Inattentive Factor

- Short attention span
- Difficulty staying on task
- Changes activities
- Easily distracted
- Doesn't focus
- Acts before thinking

Discriminant Analysis Results

- No school difficulties, no physician diagnosis -.11
- Physician diagnosis, no school difficulties .19
- School difficulties, no physician diagnosis .15
- School difficulties, physician diagnosis .62

Can ADHD Symptoms Been Seen In Children Under the Age of Three Years ?



- 66/702 moms (9%) reported physicians diagnosed child with hyperactivity/ ADD behavior
- 126/702 mothers (18%) reported child receiving special education services or had been retained

Conclusions

- ADHD symptomotology can be identified by age 2½ through observations during an eight minute free play videotaped interaction of children with their mothers.
- High scores on the inattentiveness factor predict physician diagnosis of ADD /or ADHD by age 8.
- High scores on the inattentiveness factor predict special education placement and /or grade retention by age 8.

Implications

- Results suggest that ADHD type behaviors can be identified before the age of three years.
- Results support the ability of the ADHD-ORS to predict the likelihood of ADHD behaviors and suggest that the scale can be used as a screening tool to identify young children in need of further assessment.
- Earlier identification of children with ADHD can lead to understanding of needs and the adoption of interventions (environmental, behavioral, medical) to manage symptoms and facilitate learning.

Coping with ADHD: Suggested Strategies

- View the child as a good child with a special need
- Capitalize on the child's strengths
- Emphasize the positive and be a good listener
- Follow appropriate behavior with immediate and positive feedback
- Reward and praise good behavior frequently
- Reduce distractions
- Secure attention (eye contact) before giving instructions
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- Strive for consistency
- Be sure the child understands the consequences of not following directions
- Be patient and low key, but firm
- Act, don't over talk
- Understand and use "time out" if the results are effective
- Plan ahead for situations that could be difficult
- Provide for a special one to one time for the child each day

ADHD in Children Under Three Years: Screening and Assessment Strategies

Rebecca R. Fewell, Ph.D.
University of Miami School of Medicine
Washington State Infant and Early Childhood Conference
Connections 2001
May 3, 2001

What is ADHD ?

- A persistent pattern of inattention and/or hyperactivity that is more frequent and severe than typically observed in children of the same age
- Symptoms must have been present since before age 7
- Symptoms must be present in at least two situations and are chronic in nature
- Symptoms interfere with developmentally appropriate
- Symptoms can not be accounted for by other disorders

What is the Cause of ADHD ?

- Between 30% and 50% of ADHD appears to be inherited.
- Deficient functioning in areas of the brain that involve response inhibition, attention, and sensitivity to rewards and punishment appear to characterize some children with ADHD.
- ADHD is NOT caused by brain injury or external factors like sugar ingestion.
- The manner in which parents raise their children is NOT thought to be a chief cause of ADHD.

How Common is ADHD ?

- ADHD occurs in approximately 3-5% of the school-age population
- ADHD is more common in boys than in girls 6:1 as compared to 3:1
- Many children are described as having this condition but have not been diagnosed
- ADHD often occurs along with other problems

What Other Problems Are Associated with ADHD ?

- Learning disabilities
- Perceptual-motor problems
- Low self-esteem
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- Oppositional defiant or conduct disorders
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- Accidental injuries
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Are There Some Risk Factors for ADHD ?

- Genetic Risks
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- Subjects were part of a larger study of low birth-weight, premature infants, the Infant Health and Development Program (IHDP).
- IHDP was an 8 site, 3 year early intervention program with 995 subjects randomly assigned to intervention and follow-up groups.
- Data were collected at ages 5, 6.5 and 8.

Videotaping Procedure

- Parents were videotaped with their children at 2½ years of age using a standardized protocol.
- Mothers were instructed to play with their children as if they had set aside a time just for them.
- Age appropriate toys were available throughout the 8 minute free play session that was the focus of interest for this study.

Subjects (N=702)

- Videotaped subset from original IHDP study
  Arkansas =112; Einstein =108; Harvard =92; Miami =65; Penn =54; Texas =105; Washington =99; Yale =67
- Intervention =273; Follow-up =429
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Aim

To determine if ADHD type behaviors observed at age 2½ in low birthweight, premature children are predictive of

- physician diagnosis of ADHD at age 8
- school difficulties at age 8.

ADHD Observational Rating Scale

- **Overactivity**
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  - Restless, fidgets
  - Easily excited, talks excessively
- **Impulsivity**
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  - Changes activities
  - Acts before thinking, rushes, careless
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- **Inattention**
  - Easily distracted
  - Doesn't focus to follow directions
  - Short attention span
  - Difficulty staying on task

Predictor Measure

- ***Attention Deficit Hyperactivity Disorder - Observational Rating Scale***, ADHD-ORS (Deutscher & Fewell, 1996)
- 12 items
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Outcome Measures

- Maternal response to 4 questions at 8 year interview
- ***Physician diagnosis***
- the child had **ADD** and/or
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- ***School difficulties***
- child classified needing **special education** and/or
- child had **repeated a grade.**

Data Analysis

- Promax factor analysis identified 3 factors: inattentiveness, impulsivity and overactivity.
- Preliminary analyses examined sex, birthweight and group assignment differences on the three factors
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and physician diagnosis at age 8.
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and school difficulties at age 8.

Results

- Scores on one of the ADHD-ORS factors measured at 2½, **inattentiveness, predicted physician diagnosis** ($p < .05$). Children with higher scores on this factor were significantly more likely to have a physician diagnosis by age 8.
- Scores on the **three factor model** of the ADHD-ORS measured at age 2½ predicted children who had experienced **school difficulties** at age 8 ($p < .05$). However, only the **inattentiveness** factor was a significant contributor ($p < .01$). Children with higher scores on inattentiveness were significantly more likely to have received special education services or have been retained by age 8.

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Discriminant Analysis Results

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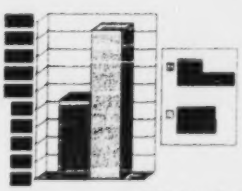

- 66/704 moms (9%) reported physicians diagnosed child with hyperactivity/ ADD behavior
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Conclusions

- ADHD symptomotology can be identified by age 2½ through observations during an eight minute free play videotaped interaction of children with their mothers.
- High scores on the inattentiveness factor predict physician diagnosis of ADD /or ADHD by age 8.
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Implications

- Results suggest that ADHD type behaviors can be identified before the age of three years.
- Results support the ability of the ADHD-ORS to predict the likelihood of ADHD behaviors and suggest that the scale can be used as a screening tool to identify young children in need of further assessment.
- Earlier identification of children with ADHD can lead to understanding of needs and the adoption of interventions (environmental, behavioral, medical) to manage symptoms and facilitate learning.

Early Predictors of ADHD in Children Under the Age of Three Years

Sponsored by U.S. Department of Special Education Grant # H023C97023

Presented at MCCD on December 21, 1999
Rebecca R Fewell and Barbara Deutscher

Nomenclature Over the Years

- brain damage syndrome
- minimal brain damaged
- organic driveness
- hyperkinetic impulse disorder
- hyperactive child syndrome
- attention deficit disorder with and without hyperactivity
- attention deficit hyperactivity disorder

Definition of ADHD

- a persistent pattern of **inattention and/or hyperactivity-impulsivity**
- more frequent and severe for developmental age
- symptoms often arise in early childhood
- chronic in nature
- not accounted by other disorders
- present in 2 or more settings

Background

- most common neuro-behavioral disorder of childhood
- 3% - 5% of school-aged children have significant educational problems because of ADHD
- associated with co-morbid disorders
- past studies have focused on school-aged children
- little research has been done with toddlers and preschoolers.

IHDP Study Background

- Subjects for this study were part of a larger study of low birth-weight premature infants, the Infant Health and Development Program (IHDP).
- IHDP was an 8 site, 3 year early intervention program with 995 subjects randomly assigned to intervention and follow-up groups.
- Data were collected at ages 5, 6.5 and 8.

Videotaping Procedure

- Parents who consented were videotaped with their children at 2½ years of age using a standardized protocol.
- Mothers were instructed to play with their children as if they had set aside a time just for them. Age appropriate toys were available throughout the 8 minute free play session that was the focus of interest for this study.

Subjects by Sites (N=702)

- Arkansas (n=112)
- Einstein (n=108)
- Harvard (n=92)
- Miami (n=65)
- Penn (n=54)
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- Washington (n=99)
- Yale (n=67)

Subject Characteristics

- Intervention (n=273)
- Follow-up (n=429)
- Mean birth-weight =1804 grams
- Sex
  - 51.0% male
- Ethnicity
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  - 11% Other

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- 12 items
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- Two coders trained
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FACTOR ANALYSIS

ADHD-ORS (Deutscher & Fewell, 1996)
Principal Components: PROMAX Rotation

	Factor 1 Inattentiveness	Factor 2 Impulsivity	Factor 3 Overactivity
Short attention span	.91	.03	-.09
Difficulty staying on task	.86	-.14	.08
Changes activities	.84	.01	.06
Easily distracted	.79	.07	.02
Doesn't focus	.72	.04	-.07
Acts before thinking	.66	.07	.16
Easily excited	-.10	.86	.06
Blurts out	.00	.82	.00
Can't wait	.28	.53	-.12
Restless, fidgets	-.05	-.14	.97
Moves fast	-.00	.32	.62
Always on the go	.27	.11	.60

Outcome Measures

- *Physician diagnosis*
  - the child had ADD and/or
  - the child was hyperactive.
- *School difficulties*
  - child classified needing special education and/or
  - child had repeated a grade.

Data Analysis

- Previously completed promax factor analysis identified 3 factors: inattentiveness, impulsivity and overactivity
- Preliminary analyses examined sex, birthweight and group assignment differences on the three factors
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and physician diagnosis at age 8
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and school difficulties at age 8

Results

- Preliminary analyses indicated **no sex, birth-weight or group assignment differences on the 3 ADHD factors.**
- Scores on one of the ADHD-ORS factors measured at 2½, **inattentiveness, predicted physician diagnosis** ($p < .05$). Children with higher scores on this factor were significantly more likely to have a physician diagnosis by age 8.
- Scores on the three factor model of the ADHD-ORS measured at age 2½ predicted children who had experienced **school difficulties** at age 8 ($p < .05$). However, only the **inattentiveness factor was a significant contributor** ($p=<.01$). Children with higher scores on inattentiveness were significantly more likely to have received special education services or have been retained by age 8.

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- Understand and use "time out" if the results are effective
- Plan ahead for situations that could be difficult
- Provide for a special one to one time for the child each day

The Relationship Between Early ADHD Symptomology and Mothers' Perceptions of Behavior

Presented by
Rebecca R. Fewell and Barbara Deutscher
MCCD Seminar Series
September 29, 2000

Sponsored by U.S. Department of Special Education
Grant # H023C97023

Research Objective

To determine the ability of
- observations of ADHD-like behavior at 30 mo
- race/ethnicity
- group assignment (intervention or control)

to predict maternal report of ADHD-like behaviors on selected CBCL items at 36 months in low birth-weight, premature infants

Introduction

- ADHD most common neurobehavioral disorder of childhood
- Affects 3-5% of school-age children
- Increasing numbers of under school aged children being seen by physicians for behavioral concerns
- Physicians responding to parents, teachers and child care staff for medication to manage the behavior

Introduction

- Multidisciplinary evaluations rarely occur
- Few diagnostic measures available for children under the age of 3 years
- Further work is needed to identify early signs of ADHD in young children

Method
Background

Infant Health and Development Program (IHDP)

- An 8 site, 3 year early intervention program with 995 subjects randomly assigned to intervention and follow-up groups
- Sites included Arkansas, Einstein, Harvard, Miami, Penn, Texas, Washington and Yale

Method
Background

Videotaping Procedure

- Mothers videotaped with their children at 30 months of age using a standardized protocol
- Mothers Instructed to play with their children as if they had set aside a time just for them. Age appropriate toys available for the 8 minute session

Method
Subjects

- 571 mother/child dyads with complete datasets
- Preliminary analysis indicated subsample not different from full IHDP on these variables:

Intervention	N =	226
Control	N =	335
Birth-weight	Mean =	1795 grams
Race		
Black		53%
White		37%
Hispanic/Other		10%

Method
Measures

The Attention Deficit Hyperactivity Disorder Observational Rating Scale (ADHD-ORS; Deutscher & Fewell, 1996)

- designed for use with very young children
- consists of 12 items
- rated on a 5 point Likert scale
- preliminary analyses using a promax rotation confirmed a three factor scale **(inattention, impulsivity and overactivity)**
- 3 factor scores used in the prediction model along with race/ethnicity and group assignment

FACTOR ANALYSIS

ADHD-ORS (Deutscher & Fewell, 1996)
Principal Components: PROMAX Rotation

	Factor 1 Inattentiveness	Factor 2 Impulsivity	Factor 3 Overactivity
Always on the go	.27	.11	**.60**
Moves fast	-.00	.32	**.62**
Restless, fidgets	-.05	-.14	**.97**
Easily excited	-.10	**.86**	.06
Can't wait	.28	**.53**	-.12
Changes activities	**.84**	.01	.06
Acts before thinking	**.66**	.07	.16
Blurts out	.00	**.82**	.00
Easily distracted	**.79**	.07	.02
Doesn't focus	**.72**	.04	-.07
Short attention span	**.91**	.03	-.09
Difficulty staying on task	**.86**	-.14	.08

Method
Measures

Child Behavior Checklist for Ages 2-3 (CBCL 2-3; Achenbach, 1986)

Composite score included 7 items completed by mothers when children were 36 months

- child can't concentrate
- child can't sit still
- child can't stand waiting
- child is easily frustrated
- child gets into everything
- child quickly shifts activities
- child is unusually loud

Method
Procedure

- Videotapes rated by trained coders for ADHD- like behaviors
- Rater reliability was high (exact averaged 89% [range 82-98%] and (within one averaged 99.5% [range 97-100%])
- Scores then combined with the archived IHDP data base that was available to the investigators

Method
Data Analysis

Separate stepwise multiple regression analyses used to determine the contributions of the five predictor variables on maternal response to selected CBCL items

Results

- The total model accounted for 10% of the variance in the CBCL
- Three of the five variables contributed significantly
- Inattention contributed 7%, race/ethnicity 2%, and group 1%

Results

Input Variables	Outcome Variable: CBCL
Full Model	10 %**
ADHD-ORS	
Inattention	7 %**
Impulsivity	
Overactivity	
Race	2 %*
Black	
White	
Hispanic/Other	
Group	1 %*
Intervention	
Control	

** $p = < .001$ * $p = < .01$

Discussion

- Inattention the key factor in the observation of early ADHD-like behavior
- Children higher on inattention factor more likely to be identified by their mothers as having ADHD-like behaviors at 36 months

Discussion

- Mothers of Black and Hispanic children more likely to rate them as exhibiting ADHD-like behavior than mothers of White children
- Mothers of children enrolled in intervention group more likely to rate them as exhibiting fewer ADHD-like behaviors than mothers of the children in the control group

Conclusions

- Findings indicate trained observers can identify ADHD-like behavior in children under the age of 3 years as confirmed by their mother's perceptions six months later
- Of interest is that these behaviors can be observed during a short, 8 minute videotape of mother-child interaction

References

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Poster Session
MCCD

Early Predictors of Attention-Deficit/Hyperactivity Disorder (ADHD) and School Difficulties

Sponsored by U.S. Department of Special Education Grant
H023C97023

Barbara Deutscher and
Rebecca R. Fewell

Abstract

A major aim of this study was to determine if ADHD type behaviors observed at age 2½ in low birthweight children are predictive of ADHD and school difficulties at age 8. Videotapes of mother-child interactions, during eight minutes of free play, were coded for ADHD symptomotology. Factor scores derived from the ADHD observational scale were used to predict two outcome variables, maternal report of physician diagnosis of ADD and/or hyperactivity, and maternal report of special education placement and/or grade retention. Results indicate ADHD like behavior can be observed at this young age during interactions. The inattentiveness factor predicted both physician diagnosis and school difficulties.

Introduction

- ADHD is the most common neuro-behavioral disorder of childhood, affecting children from early childhood through school and into their adult life.
- 3% - 5% of school-aged children have significant educational problems because of ADHD. However, little is known about the onset of this difficult to diagnose syndrome.
- Past studies have focused on school-aged children with ADHD, the comorbidity of ADHD with other disorders, and treatment medications. Little research has been done with toddlers and preschoolers.

Method

Background, Procedure

IHDP Study

- Subjects for this study were part of a larger study of low birth-weight premature infants, the Infant Health and Development Program.
- IHDP was an 8 site, 3 year early intervention program with 995 subjects randomly assigned to intervention and follow-up groups.
- Longitudinal data were collected at ages 5, 6.5 and 8.

Videotaping Procedure

- Parents who consented were videotaped with their children at 2½ years of age using a standardized protocol.
- Mothers were instructed to play with their children as if they had set aside a time just for them. Age appropriate toys were available throughout the 8 minute free play session that was the focus of interest for this study.

Method

Subjects (N=702)

- Videotaped subset from original IHDP study
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  Wash (n=99) Yale (n=67)
- Intervention (n=273) Follow-up (n=429)
- Mean birth-weight=1804 grams
- 51.0% male
- Ethnicity=38% White, 51% African American, 11% Other

Method

Measures

- *Attention Deficit Hyperactivity Disorder -Observational Rating Scale*, ADHD-ORS (Deutscher & Fewell, 1996) This 12 item scale was designed for use in this study. A 1-5 likert scale was used to code items. Two coders were trained by one of the scale developers. Interrater reliability within one for the 702 videotapes averaged 99%. Exact reliability averaged 89% across the 8 sites.
- *Physician diagnosis* This variable was created from maternal response to 2 questions at the age 8 interview-the physician reporting the child had ADD and/or the child was hyperactive.
- *School difficulties* This variable was created from maternal response to 2 questions at the age 8 interview-whether the child was classified as needing special education and/or whether the child had repeated a grade.

Method

Data Analysis

- Previously completed promax factor analysis identified 3 factors: inattentiveness, impulsivity and overactivity. (See Table 1).
- Preliminary analyses examined sex, birthweight and group assignment differences on the three factors
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and physician diagnosis at age 8.
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and school difficulties at age 8.

Table 1: FACTOR ANALYSIS
ADHD-ORS (Deutscher & Fewell, 1996)
Principal Components: PROMAX Rotation

	Factor 1 Inattentiveness	Factor 2 Impulsivity	Factor 3 Overactivity
Short attention span	.91	.03	-.09
Difficulty staying on task	.86	-.14	.08
Changes activities	.84	.01	.06
Easily distracted	.79	.07	.02
Doesn't focus	.73	.04	-.07
Acts before thinking	.66	.07	.16
Easily excited	-.10	.96	.06
Blurts out	.00	.82	.00
Can't wait	.28	.53	-.12
Restless, fidgets	-.05	-.14	.97
Moves fast	-.00	.32	.62
Always on the go	.27	.11	.60

Results

- Preliminary analyses indicated no sex, birth-weight or group assignment differences on the 3 ADHD factors.
- Scores on one of the ADHD-ORS factors measured at 2½, inattentiveness, predicted physician diagnosis ($p < .05$). Children with higher scores on this factor were significantly more likely to have a physician diagnosis by age 8.
- Scores on the three factor model of the ADHD-ORS measured at age 2½ predicted children who had experienced school difficulties at age 8 ($p < .05$). However, only the inattentiveness factor was a significant contributor ($p = < .01$). Children with higher scores on inattentiveness were significantly more likely to have received special education services or have been retained by age 8.

Conclusions

- ADHD symptomotology can be identified by age 2½ through observations during an eight minute free play videotaped interaction of children with their mothers.
- High scores on the inattentiveness factor predict physician diagnosis of ADD and/or hyperactivity by age 8.
- High scores on the inattentiveness factor predict special education placement and/or grade retention by age 8.

Implications

- Results suggest that ADHD type behaviors can be identified before the age of three years.
- Results support the ability of the ADHD-ORS to predict the likelihood of ADHD behaviors and suggest that the scale can be used as a screening tool to identify young children in need of further assessment.
- Earlier identification of children with ADHD can lead to greater understanding of child needs and the adoption of environmental, behavioral and medical interventions to manage symptoms and facilitate learning.

ADHD in Children Under Three Years: Screening and Assessment Strategies

Rebecca R. Fewell, Ph.D.
University of Miami School of Medicine
Washington State Infant and Early Childhood Conference
Connections 2001
May 3, 2001

Brain and Behavior

- It takes a "team" effort for a brain to work well. These processes must be orchestrated for learning to occur:
  - Being awake and alert
  - Being motivated
  - Being perceptive
  - Being attentive
  - Being adaptive
- If these processes or plasticity in the synapses are faulty, then learning will be muted or permanently blocked

Brain Research and Behavior

- Researchers have investigated what happens in the brain when mistakes are made ("blunder blips", "oops" and "impulse conflicts")
- Researchers have investigated to what extent impulses are automatic and how well children can control them
- Researchers have studied "stop" and "go" signals when they are competing in the brain

Brain, Behavior and ADHD

- Researchers have studied "stop and go" impulse control in children with ADHD
  - Children with ADHD were slower to respond to "stop" signals than typically developing children
- Intervention is needed
  - Ritalin is used to treat this condition
  - Cognitive/Behavioral strategies can be used effectively
  - In some situations, both are needed

What is ADHD ?

- A persistent pattern of inattention and/or hyperactivity that is more frequent and severe than typically observed in children of the same age
- Symptoms must have been present since before age 7
- Symptoms must be present in at least two situations and are chronic in nature
- Symptoms interfere with developmentally appropriate
- Symptoms can not be accounted for by other disorders

What is the Cause of ADHD ?

- Between 30% and 50% of ADHD appears to be inherited.
- Deficient functioning in areas of the brain that involve response inhibition, attention, and sensitivity to rewards and punishment appear to characterize some children with ADHD.
- ADHD is NOT caused by brain injury or external factors like sugar ingestion.
- The manner in which parents raise their children is NOT thought to be a chief cause of ADHD.

How Common is ADHD ?

- ADHD occurs in approximately 3-5% of the school-age population
- ADHD is more common in boys than in girls 6:1 as compared to 3:1
- Many children are described as having this condition but have not been diagnosed
- ADHD often occurs along with other problems

What Other Problems Are Associated with ADHD ?

- Learning disabilities
- Perceptual-motor problems
- Low self-esteem
- Depression or temper problems
- Oppositional defiant or conduct disorders
- Poor peer relations
- Accidental injuries
- Family Stress

Are There Some Risk Factors for ADHD ?

- Genetic Risks
  - Family history of hyperactivity, conduct disorder, alcoholism, learning disorders
- Medical Risks
  - Pregnancy problems
  - Maternal use of drugs and alcohol
  - Head trauma
  - Chronic medical illness such as asthma

IHDP Study Background

- Subjects were part of a larger study of low birth-weight, premature infants, the Infant Health and Development Program (IHDP).
- IHDP was an 8 site, 3 year early intervention program with 995 subjects randomly assigned to intervention and follow-up groups.
- Data were collected at ages 5, 6.5 and 8.

Videotaping Procedure

- Parents were videotaped with their children at 2½ years of age using a standardized protocol.
- Mothers were instructed to play with their children as if they had set aside a time just for them.
- Age appropriate toys were available throughout the 8 minute free play session that was the focus of interest for this study.

Subjects (N=702)

- Videotaped subset from original IHDP study
  Arkansas =112; Einstein =108; Harvard =92; Miami =65; Penn =54; Texas =105; Washington =99; Yale =67
- Intervention =273; Follow-up =429
- Mean birth-weight =1804 grams
- 51.0% male
- Ethnicity =38% White, 51% Afri. Amer., 11% Other

Aim

To determine if ADHD type behaviors observed at age 2½ in low birthweight, premature children are predictive of

- physician diagnosis of ADHD at age 8
- school difficulties at age 8.

ADHD Observational Rating Scale

- **Overactivity**
  - Always on the go
  - Moves fast
  - Restless, fidgets
  - Easily excited, talks excessively
- **Impulsivity**
  - Can't wait, frustrates easily
  - Changes activities
  - Acts before thinking, rushes, careless
  - Blurts out, interrupts, loud, noisy
- **Inattention**
  - Easily distracted
  - Doesn't focus to follow directions
  - Short attention span
  - Difficulty staying on task

Predictor Measure

- ***Attention Deficit Hyperactivity Disorder - Observational Rating Scale***, ADHD-ORS (Deutscher & Fewell, 1996)
- 12 items
- 1-5 likert scale
- Two coders trained
- Interrater reliability within one for 702 videotapes averaged 99%
- Exact reliability averaged 89% across the 8 sites.

Outcome Measures

- Maternal response to 4 questions at 8 year interview
- ***Physician diagnosis***
- the child had **ADD** and/or
- the child was **hyperactive.**
- ***School difficulties***
- child classified needing **special education** and/or
- child had **repeated a grade.**

Data Analysis

- Promax factor analysis identified 3 factors: inattentiveness, impulsivity and overactivity.
- Preliminary analyses examined sex, birthweight and group assignment differences on the three factors
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and physician diagnosis at age 8.
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and school difficulties at age 8.

Results

- Scores on one of the ADHD-ORS factors measured at 2½, **inattentiveness, predicted physician diagnosis** ($p < .05$). Children with higher scores on this factor were significantly more likely to have a physician diagnosis by age 8.
- Scores on the **three factor model** of the ADHD-ORS measured at age 2½ predicted children who had experienced **school difficulties** at age 8 ($p < .05$). However, only the **inattentiveness** factor was a significant contributor ($p < .01$). Children with higher scores on inattentiveness were significantly more likely to have received special education services or have been retained by age 8.

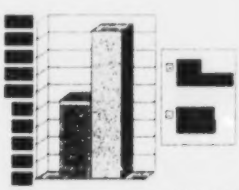
Items Loading on Inattentive Factor

- Short attention span
- Difficulty staying on task
- Changes activities
- Easily distracted
- Doesn't focus
- Acts before thinking

Discriminant Analysis Results

- No school difficulties, no physician diagnosis -.11
- Physician diagnosis, no school difficulties .19
- School difficulties, no physician diagnosis .15
- School difficulties, physician diagnosis .62

Can ADHD Symptoms Been Seen In Children Under the Age of Three Years ?



- 66/702 moms (9%) reported physicians diagnosed child with hyperactivity/ ADD behavior
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Conclusions

- ADHD symptomotology can be identified by age 2½ through observations during an eight minute free play videotaped interaction of children with their mothers.
- High scores on the inattentiveness factor predict physician diagnosis of ADD /or ADHD by age 8.
- High scores on the inattentiveness factor predict special education placement and /or grade retention by age 8.

Implications

- Results suggest that ADHD type behaviors can be identified before the age of three years.
- Results support the ability of the ADHD-ORS to predict the likelihood of ADHD behaviors and suggest that the scale can be used as a screening tool to identify young children in need of further assessment.
- Earlier identification of children with ADHD can lead to understanding of needs and the adoption of interventions (environmental, behavioral, medical) to manage symptoms and facilitate learning.

Poster Session
World Association for Infant Mental Health
July 2000 - Montreal

The Relationship Between Early ADHD Symptomology and Mothers' Perceptions of Behavior

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Sponsored by U.S. Department of Special Education
Grant # H023C97023

Research Objective

To determine the ability of observations of ADHD-like behaviors made at 30 months of age, race/ethnicity, and intervention or control group assignment to predict maternal report of ADHD-like behaviors on selected items from the 36 month Child Behavior Checklist in a group of low birth-weight, premature infants.

Background

ADHD is the most common neurobehavioral disorder of childhood, affecting 3-5% of school-age children. The increasing numbers of very young children diagnosed is a point of recent concern. Physicians are responding to the urgent pleas of parents, teachers and child care staff for diagnosis and medication to manage the behavior. These requests are occurring outside of a multidisciplinary evaluation of the child that might uncover other causes of the behavior. A paucity of diagnostic measures for children under the age of 3 years further complicates the problem. Further work is needed to identify early signs of ADHD in young children.

Background (cont'd)

The Infant Health and Development Program (IHDP) was a randomized 3 year clinical trial at 8 medical schools across the country designed to evaluate the efficacy of an intensive early intervention in reducing health and developmental problems of low birth-weight, premature infants. Parents who consented were videotaped with their children at 2½ years of age using a standardized protocol. Mothers were instructed to play with their children as if they had set aside a time just for them. Age appropriate toys were available throughout the 8 minute session that was the focus of interest for this study.

Method

Subjects

Subjects were a subsample of the 985 low birth-weight, premature infants who participated in the IHDP and had complete data sets (n=571). Preliminary analysis results indicated that the subsample was not different from the full IHDP sample on any of these variables.

Intervention	N =	226
Control	N =	335
Birth-weight	Mean =	1795 grams
Race		
Black		53%
White		37%
Hispanic/Other		10%

Method

Measures

The Attention Deficit Hyperactivity Disorder Observational Rating Scale (ADHD-ORS; Deutscher & Fewell, 1996) This measure was designed to use with very young children and consists of 12 items that are rated on a 5 point Likert scale. Preliminary analyses using a promax rotation confirmed a three factor scale (**inattention, impulsivity and overactivity**). Factor scores were used in the prediction model.

In addition, two other factors, **race/ethnicity** and intervention or control **group assignment**, were entered into the prediction model resulting in five predictors.

Method

Measures (cont'd)

Child Behavior Checklist for Ages 2-3 (CBCL 2-3; Achenbach, 1986) The single outcome measure for this investigation was a composite score from 7 items selected from the CBCL that had been completed by the mothers when the children were 36 months of age. They included child can't concentrate, child can't sit still, child can't stand waiting, child is easily frustrated, child gets into everything, child quickly shifts activities, and child is unusually loud.

FACTOR ANALYSIS
ADHD-ORS (Deutscher & Fewell, 1996)
Principal Components: PROMAX Rotation

	Factor 1 Inattentiveness	Factor 2 Impulsivity	Factor 3 Overactivity
Always on the go	.27	.11	**.60**
Moves fast	-.00	.32	.62
Restless, fidgets	-.05	-.14	**.97**
Easily excited	.10	**.86**	.00
Can't wait	.28	**.53**	-.12
Changes activities	**.84**	.01	.06
Acts before thinking	**.66**	.07	.16
Hurts out	.00	**.82**	.00
Easily distracted	**.79**	.07	.02
Doesn't focus	**.72**	.04	-.07
Short attention span	**.91**	.03	-.09
Difficulty staying on task	**.86**	-.14	.08

Method

Procedure

Videotapes made of the mothers and their toddlers playing together when they were 30 months of age were coded using the ADHD-ORS. These scores were then combined with the archived IHDP data base that was available to the investigators. Coder reliability regarding exact and within one ratings confirmed high reliability (exact averaged 89% [range 82-98%] and within one averaged 99.5% [range 97-100%].

Method

Data Analysis

Separate stepwise multiple regression analyses were used to determine the independent and interactive contributions of the five predictor variables on maternal response to selected CBCL items at 36 months.

Results

The total model accounted for 10% of the variance in the CBCL. Three of the 5 variables contributed significantly. Inattention contributed 7%, race/ethnicity 2%, and group 1%.

Input Variables	Outcome Variable CBCL
Full Model	10%**
ADHD-ORS	
Inattention	7%**
Impulsivity	
Overactivity	
Race	2%*
Black	
White	
Hispanic/Other	
Group	1%*
Intervention	
Control	

** $p = .001$ * $p = .01$

Discussion

The results of this study are noteworthy for several reasons. First, inattention appears to be the key factor in the observation of early ADHD-like behavior. In the factor analysis, 6 of the 12 items loaded on this factor. Children who were higher on the inattention factor of the ADHD-ORS were also more likely to be identified as having ADHD-like behaviors by their mothers at 36 months on similar items on the CBCL. Mothers of Black and Hispanic children were more likely to rate their

Discussion (cont'd)

children as exhibiting ADHD-like behavior on the CBCL than were mothers of White children. Finally, mothers of children enrolled in the intervention group, which began at birth and continued for three years, rated their children as exhibiting fewer ADHD-like behaviors on the selected items from the CBCL than did mothers of the children in the control group.

Conclusions

These findings indicate that trained observers can identify ADHD-like behavior in children under the age of 3 years as confirmed by their mother's perceptions six months later. Of particular interest to researchers and practitioners is the fact that these behaviors can be observed during a short, 8 minute videotape of mother-child interaction.

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Achenbach, T.M., Edelbrock, C.S., Howell, C.T. (1987). Empirically based assessment of the behavioral/emotional programs of 2- and 3-year-old children. Journal of Abnormal Child Psychology, 15, 629-650.

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Early Predictors of ADHD in Children Under the Age of Three Years

Barbara Deutscher
Rebecca R. Fewell
University of Miami School of Medicine

Presented at the FLASHA Convention
May 25, 2001
Sponsored by U.S. Department of Special Education
Grant # H023C97023

Terminology Over Time

- Brain damage syndrome
- Minimal brain damaged
- Organic driveness
- Hyperkinetic impulse disorder
- Hyperactive child syndrome
- Attention deficit disorder with and without hyperactivity
- Attention deficit hyperactivity disorder

What is ADHD?

- A persistent pattern of inattention and/or hyperactivity-impulsivity
- More frequent and severe for developmental age
- Symptoms often arise in early childhood
- Symptoms must be present before age seven
- Chronic in nature
- Not accounted for by other disorders
- Present in 2 or more settings

How Common Is ADHD?

- Most common neuro-behavioral disorder of childhood
- 3%-5% of school-aged children have significant educational problems because of ADHD
- Diagnosed more frequently in boys than girls
- Associated with co-morbid disorders

Problems Associated With ADHD

- Learning Disabilities
- Reading Disorders
- Language Impairment
- Conduct Disorder
- Oppositional Defiant Disorder
- Accidental Injuries
- Family Stress and Discord

What Do We Know?

- Past studies have focused on school-aged children and now even adults
- Extensive literature on ADHD and LD, LI, CD, ODD
- Many studies on the treatment of ADHD with medication
- Much research now using brain imaging and trying to understand the genetic basis
- Little research has been done with toddlers and preschoolers

Aim

To determine if ADHD type behaviors observed at 2½ years of age in low birth-weight, premature children are predictive of:

- **physician diagnosis of ADHD at age 8**
- **school difficulties at age 8**

IHDP Study Background

- **Subjects for this study were part of a larger study of low birth-weight premature infants, the Infant Health and Development Program (IHDP)**
- **IHDP was an 8 site, 3 year early intervention program with 995 subjects randomly assigned to intervention and follow-up groups**
- **Data were collected at ages birth-3, 5, 6.5 and 8 years**

Subjects by Sites (N=571)

- **Arkansas (n=103)**
- **Einstein (n=83)**
- **Harvard (n=60)**
- **Miami (n=49)**
- **Penn (n=48)**
- **Texas (n=90)**
- **Washington (n=83)**
- **Yale (n=55)**

Subject Characteristics

- **Intervention (n=191)**
- **Follow-up (n=380)**
- **Mean birth-weight =1795 grams**
- **Sex**
  - **51% male**
- **Ethnicity**
  - **37% White**
  - **53% African American**
  - **10% Other**

Videotaping Procedure

- **Parents who consented were videotaped with their children at 2½ years of age using a standardized protocol**
- **Mothers were instructed to play with their children as if they had set aside a time just for them. Age appropriate toys were available throughout the 8 minute free play session that was the focus of interest for this study**

Predictor Measure

Attention Deficit Hyperactivity Disorder-Observational Rating Scale (ADHD-ORS); Deutscher & Fewell, 1996

- **12 items**
- **1-5 likert scale**
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ADHD Observational Rating Scale

Overactivity
- Always on the go
- Moves fast
- Restless, fidgets
- Easily excited, talks excessively

Impulsivity
- Can't wait, frustrates easily
- Changes activities
- Acts before thinking, rushes, careless
- Blurts out, interrupts, loud, noisy

Inattention
- Easily distracted
- Doesn't focus to follow directions
- Short attention span
- Difficulty staying on task

Outcome Measures

Physician Diagnosis
- the child had ADD and/or
- the child was hyperactive

School Difficulties
- child classified needing special education and/or
- child had repeated a grade

Data Analysis

- Previously completed promax factor analysis identified 3 factors: inattentiveness, impulsivity and overactivity
- Preliminary analyses examined sex, birth-weight and group assignment differences on the three factors
- Logistic regression analyses used to determine the relationship between the three ADHD factors, observed at age 2½, and physician diagnosis at age 8
- Logistic regression analyses were used to determine the relationship between the three ADHD factors, observed at age 2½, and school difficulties at age 8

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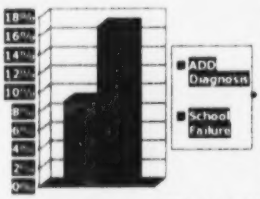
Children Diagnosed By Age 8



- 66/702 moms (9%) reported physicians diagnosed child with hyperactivity/ ADD behavior
- 126/702 mothers (18%) reported child receiving special education services or had been retained

IHDP Study of Low-Birthweight Premature Infants

Items Loading on the Inattentiveness Factor

- Easily distracted
- Doesn't focus to follow directions
- Short attention span
- Difficulty staying on task
- Changes activities
- Acts before thinking

Discriminant Analysis Results

- No school difficulties, no physician diagnosis -.11
- Physician diagnosis, no school difficulties .19
- School difficulties, no physician diagnosis .15
- School difficulties, physician diagnosis .62

Conclusions

- ADHD symptomotology can be identified by age 2½ through observations during an eight minute free play videotaped interaction of children with their mothers
- High scores on the inattentiveness factor predict physician diagnosis of ADD and/or hyperactivity by age 8
- High scores on the inattentiveness factor predict special education placement and/or grade retention by age 8

Implications

- Results suggest that ADHD type behaviors can be identified before the age of three years
- Results support the ability of the ADHD-ORS to predict the likelihood of ADHD behaviors and suggest that the scale can be used as a screening tool to identify young children in need of further assessment
- Earlier identification of children with ADHD can lead to greater understanding of child needs and the adoption of environmental, behavioral and medical interventions to manage symptoms and facilitate learning

Coping with ADHD: Suggested Strategies

- View the child as a good child with a special need
- Capitalize on the child's strengths
- Emphasize the positive and be a good listener
- Follow appropriate behavior with immediate and positive feedback
- Reward and praise good behavior frequently
- Reduce distractions
- Secure attention (eye contact) before giving instructions
- Keep directions simple
- Check for understanding

Coping with ADHD: Suggested Strategies

- Have clear rules
- Make sure all adults in the family support the rules
- Strive for consistency
- Be sure the child understands the consequences of not following directions
- Be patient and low key, but firm
- Act, don't over talk
- Understand and use "time out" if the results are effective
- Plan ahead for situations that could be difficult
- Provide for a special one to one time for the child each day

Second Research Question

Is there a relationship between the 3 factors of the ADHD-ORS and ratings of the children's language scored during the same videotaped session using the Vineland?

Measures

Vineland Social Maturity Scale: Expressive Communication Subscale (Sparrow, Balla, Cicchetti, 1984)

- nationally standardized
- prespeech expression, beginning talking, interactive speech use of abstract concepts, speech skills and expressions of complex ideas
- 22 items
- 0, 1, 2 scale
- Two coders trained
- Interrater reliability within one for 688 videotapes averaged 96% across the 8 sites
- Exact reliability averaged 88% across the 8 sites

Results of Correlations

- There was a significant relationship (.0001) between ADHD scores at 30 months and child language at 30 months
- Children who had higher scores on the inattentiveness factor of the ADHD-ORS had lower scores on the Vineland
- The impulsivity factor of the ADHD-ORS was correlated with the Vineland language score at the less significant level of .0
- There was no significant correlation between the overactivity factor of the ADHD-ORS and the Vineland language score

Third Research Question

Is the child's language at 30 months predictive of future verbal scores at age 3, 5 and 8 years of age?

Measures

Language Facilitation Rating Scale (Deutscher & Fewell, 1998)

- developed as a quick assessment of the language of the role model the young child has and whether it is facilitative of the development of the child's language
- single rating
- 1-5 likert scale
- Two coders trained
- Interrater reliability within one for 688 videotapes averaged 98% across the 8 sites
- Exact reliability averaged 81% across the 8 sites

Outcome Measures

Age 3

- Stanford Binet

Age 5

- Wechler Preschool and Primary Scale of Intelligence-Revised (WPPSI; Wechsler, 1989)

Age 8

- Wechsler Intelligence Scale for Children (WISC-III; Wechsler, 1991)
- Woodcock-Johnson Test of Achievement-Revised-Broad Reading (Woodcock and Johnson, 1990)

Data Analysis

- Preliminary analyses examined sex, birthweight and group assignment differences
- Multiple regression analyses were used to determine the relationship between expressive language scores observed at age 2½, and verbal competence at ages 5, and 8 year
- Multiple regression analyses were used to determine the relationship between expressive language scores observed at age 2½, and reading at age 8

Results of Stepwise Multiple Regression Analyses

- Age 3-Stanford Binet

Model Variables	Variance*
Vineland Expressive	30%
Mother's Facilitation	9%
Mother's Education	4%
Treatment Group	2%
Full Model	45%

*All listed variances are significant at .05 or greater

Results of Stepwise Multiple Regression Analyses

- Age 5-WPPSI Verbal

Model Variables	Variance
Vineland Expressive	32%
Mother's Facilitation	11%
Mother's Education	4%
Full Model	47%

*All listed variances are significant at .05 or greater

Results of Stepwise Multiple Regression Analyses

- Age 8-WISC Verbal

Model Variables	Variance
Vineland Expressive	31%
Mother's Education	11%
Mother's Facilitation	3%
Full Model	45%

*All listed variances are significant at .05 or greater

Results of Stepwise Multiple Regression Analyses Results

- Age 8-Woodcock Johnson Broad Reading

Model Variables	Variance
Vineland Expressive	25%
Mother's Education	8%
Mother's Facilitation	2%
Full Model	35%

*All listed variances are significant at .05 or greater

Conclusions

- Children's early expressive language competence can be identified by age 2½ through observations during an eight minute free play videotaped interaction of children with their mothers
- Children's expressive language performance at age 2½ predicts mental ability at age 3, verbal competence on mental measures at ages 5, and 8 years and broad reading at age 8 years

Early Predictors of Verbal Competence and Reading in Children Under the Age of Three Years

Sponsored by U.S. Department of Special Education Grant # H023C97023

Presented at MCCD on January 7, 2000
Rebecca R Fewell, Barbara Deutscher and Mary Percival

Importance of Early Verbal Competence

- Social/emotional maturity
- mental ability
- emergent literacy
- school success

Reflections on the Goals 2000

- Goals set in 1994
- "All children in America will come to school ready to learn"
- Reading critical to school success
- Verbal competence is a marker of reading ability
- Like walking and talking, reading is a milestone by which families assess their children

Aim

To determine whether observations of low birth-weight, premature children's expressive language at age 2½ are predictive of

- mental ability at age 3
- verbal scores at ages 5 and 8
- reading scores at age 8

Background

- Low birthweight, prematurely born children are at high risk for developmental delays and poor school performance
- 49% of premature children referred (Chaikind & Corman, 1990)
- excluding disabled children, 50% of premature sample had learning problems by grade 2 (Brandt et al, 1992)
- by grade 5 75% of prematurely born children fell into the categories of LD, ADD ,LI, mild neurologic impairment and general school concerns (Cherkes-Julkowski, 1998)

IHDP Study Background

- Subjects for this study were part of a larger study of low birth-weight, premature infants, the Infant Health and Development Program (IHDP).
- IHDP was an 8 site, 3 year early intervention program with 995 subjects randomly assigned to intervention and follow-up groups.
- Data were collected at ages birth-3, 5, 6.5 and 8.

Videotaping Procedure

- **Parents who consented were videotaped with their children at 2½ years of age using a standardized protocol.**
- **An 8 minute free play segment from a longer tape was used**
- **Mothers were instructed to play with their children as if they had set aside a time just for them. Age appropriate toys were available throughout the play session .**

Subjects by Sites (N=571)

- **Arkansas (n=103)**
- **Einstein (n=83)**
- **Harvard (n=60)**
- **Miami (n=49)**
- **Penn (n=48)**
- **Texas (n=90)**
- **Washington (n=83)**
- **Yale (n=55)**

Subject Characteristics

- Intervention (n=225)
- Follow-up (n=346)
- Mean birth-weight =1795 grams
- Sex
  - 51.0% male
- Ethnicity
  - 37% White
  - 53% African American
  - 10% Other

Independent Variables

- *Vineland Social Maturity Scale: Expressive Communication Subscale* (Sparrow, Balla, & Cicchetti, 1984)
  - nationally standardized
  - Pre-speech expression, beginning talking, interactive speech use of abstract concepts, speech skills and expressions of complex ideas
  - 22 items
  - 0, 1, 2 scale
  - Two coders trained
  - Interrater reliability within one for 688 videotapes averaged 96% across the 8 sites
  - Exact reliability averaged 88% across the 8 sites

Independent Variables (con't)

- *Language Facilitation Rating Scale* (Deutscher & Fewell, 1988)
  - developed as a quick assessment of the language of the role model the young child has and whether it is facilitative of the development of the child's language
  - single rating
  - 1-5 likert scale
  - Two coders trained
  - Interrater reliability within one for 688 videotapes averaged 98% across the 8 sites
  - Exact reliability averaged 81% across the 8 sites

Independent Variables (con't)

- ***Mothers Education***
  - Coded on a 5 point scale (1 = less than high school to 5 = college education)
- ***Group Assignment***
  - Random assignment to intervention or follow-up groups was made at entry

Outcome Measures

Age 3
- Stanford Binet Intelligence Scale

Age 5
- Wechsler Preschool and Primary Scale of Intelligence-Revised-Verbal Scale (WPPSI)

Age 8
- Wechsler Intelligence Scale for Children-Verbal Scale (WISC)
- Woodcock-Johnson Broad Reading

Data Analysis

- Preliminary analyses examined sex, birthweight and group assignment differences
- Multiple regression analyses were used to determine the relationship between expressive language scores observed at age 2½, and verbal competence at ages 3, 5, and 8 years.
- Multiple regression analyses were used to determine the relationship between expressive language scores observed at age 2½, and reading at age 8.

Results

Multiple Regression Analyses

- Age 3 - Stanford Binet

Model Variables	% of Explained Variation*
Full Model	45%
Vineland Expressive	30%
Mother's Facilitation	9%
Mother's Education	4%
Group Assignment	2%

*All percentages are significant at $p < .01$

Results

- Age 5 - WPPSI Verbal

Model Variables	% of Explained Variation*
Full Model	47%
Vineland Expressive	32%
Mother's Facilitation	11%
Mother's Education	4%

Results

- Age 8 - WISC Verbal

Model Variables	% of Explained Variation*
Full Model	45%
Vineland Expressive	31%
Mother's Education	11%
Mother's Facilitation	3%

Results

- Age 8 - Woodcock Johnson Broad Reading

Model Variables	% of Explained Variation
Full Model	35%
Vineland Expressive	25%
Mother's Education	8%
Mother's Facilitation	2%

Discussion

- **Children's verbal competence is dependent on many important variables**
- **When taken as a whole, the actual language we observed during play when children were 2.5 years of age is the strongest contributor to language related outcomes at later ages.**
- **Children's early language competence will be a marker of later scores on measures of cognition**

Discussion

- **Children's cognition and language performance at ages 3 and 5 appear to be significantly enhanced if mothers are good facilitators of their children's early language development.**
- **As children get into the academics of school, mother's education adds significantly more to language and reading outcomes than does mother's facilitation of language.**

Conclusions

- **Children's early expressive language competence can be identified by age 2½ through observations during an eight minute free play videotaped interaction of children with their mothers.**
- **Children's expressive language performance at age 2½ predicts mental ability at age 3.**
- **Children's expressive language performance at age 2½ predicts verbal competence on mental measures at ages 5 and 8 years.**
- **Children's expressive language performance at age 2½ predicts broad reading at age 8 years.**

Implications

- Results suggest that observations of early verbal performance predict future verbal and reading scores
- Results support the use of simple observations of language used during brief play episodes to predict later verbal performance
- Results suggest the Vineland Expressive Communication Subdomain can be used as an observational rating tool to screen young children for further verbal assessment
- Earlier identification of children with verbal delays can lead to greater understanding of child needs and the adoption of environmental and educational interventions to facilitate learning

Attention Deficit Hyperactivity Disorder in Very Young Children: Early Signs and Interventions

The number of children diagnosed with attention deficit hyperactivity disorder (ADHD) is rising. It is now considered the most common neuropsychiatric syndrome in US school-age children, affecting 3% to 5%, or approximately 2 million children. ADHD is a chemical imbalance in the brain resulting in inappropriate degrees of inattention, hyperactivity, and impulsivity; these symptoms must be present prior to age 7. ADHD is difficult to diagnose, as it is linked to many other conditions such as learning disabilities, conduct disorders, bipolar disorders, and manic-depressive illnesses. The authors offer information on behaviors signaling the need for a referral in very young children and describe the positive and negative effects of common medications. They suggest specific behavioral coping strategies for both home and group care settings. Key words: *ADHD, hyperactivity, inattention, impulsivity, young children*

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IN THE PAST decade many young children were diagnosed with a disorder that was not commonly recognized in earlier years. This condition, attention deficit hyperactivity disorder (ADHD), has become the most common neuropsychiatric syndrome in children, reported to affect 3% to 5%, or approximately 2 million school-age children according to the US Department of Education.[1] If this condition were diagnosed prior to school entry, then there would likely be a formidable surge in the request for early intervention services. By extrapolating population figures we can estimate these numbers. According to the US Census Bureau, there were over 18.9 million children under the age of 5 years in 1999.[2] Applying the 3% to 5% range to this number, we can estimate that 568,260 to 947,100 children could show early signs of ADHD.

It is likely that the number of very young children who may later be diagnosed with ADHD will be higher among those who have already been diagnosed as having special needs, or those who get services because they are at high risk for poor school performance. According to one study,[3] this problem accounts for as much as 50% of child psychiatry clinic patients. A recent study of the 1,200 children in foster care services in Broward County, Florida reported 67% (566) had a mental health diagnosis. The most common diagnosis was adjustment disorder (38%) followed by ADHD and/or disruptive behavior disorder,[4] which accounted for another 19%.[5] Unfortunately, few early childhood programs exist to assist family members in addressing their child's behavioral manifestations of this syndrome.

The rise in ADHD has recently come to the attention of the national media.[6,7] Specifically, many young children are being diagnosed after the parents describe their child's problem behaviors to their pediatrician. In instances in which the pediatrician is not able to spend considerable time investigating the problem with the child and family, one of two things frequently happens: (1) the pediatrician will tell the parent that the behavior is normal and the child will outgrow it or (2) medication is prescribed based on the concerns and pleas of the parent and the pediatrician's diagnosis. Unfortunately, it is rare for parents to present careful documentation of the troublesome behaviors or the strategies they have used in attempts to address the problems. This kind of evidence might alleviate premature diagnoses or provide a firm basis for more definitive diagnoses.

Parents and professionals who are well informed as to the distinctions between typical behaviors and behaviors that are extreme, and are thus possible signs of more serious problems, are better positioned to participate actively in the diagnostic process. Not only are they prepared to make a referral when one is appropriate, but also they may be able to begin some successful interventions before the troublesome behaviors escalate. Given that ADHD or attention deficit disorder (ADD) are seldom diagnosed in very young children, few early childhood specialists and therapists receive adequate training in their own discipline-specific programs to recognize the signs of this condition or to assist family members to address the child's behavioral manifestations of this problem. The purpose of this article is to provide an overview of information on the signs of ADHD-type behaviors as seen in very young children and to suggest referral guidelines and intervention strategies.

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DEFINING ADHD

ADHD, like learning disabilities, is multifaceted and lacks a single universally accepted definition.[8] If one looks back to the 1950s and 1960s, the characteristics we recognize today as ADHD were described during those times as minimal brain damage. Children with behaviors that exceeded what was normally expected for their age in the areas of inattention, impulsivity, and hyperactivity were characterized as children with minimal brain dysfunction as it was felt these children had experienced conditions that had damaged their brains.[9] With publication of the second edition of the *Diagnostic and Statistical Manual* (DSM-II) in 1968, a reference was made to this condition, however, the emphasis was on hyperactivity as the major presenting characteristic.[10]

By 1980, when DSM-III was published, ADD became the new title because professionals were convinced that inattention was the central deficiency. In addition to inattention, children with ADD at times demonstrate lack of impulse control and hyperactivity. ADD was seen as a chronic condition that began in infancy and could extend through adulthood. However, it was still possible to label some children as ADHD, depending on whether hyperactivity was present.[11] In 1987, when DSM-IIIR was released, the criteria for determining ADHD were included. They were in the form of a list of 14 characteristics. One notable criterion was that onset of the condition had to occur before the age of 7 years.[12] DSM-IV (1994) omitted the list of characteristics from the previous edition; rather, it grouped symptoms under the heading of either inattention or hyperactivity/impulsivity.

Individuals whose symptoms include difficulties in sustaining attention, distractibility, lack of task persistence, and disorganization are diagnosed with ADHD, "predominantly inattentive type." Individuals with excessive motor activity and impulsive responding are diagnosed as ADHD, "predominantly hyperactive-impulsive type." One could also carry the diagnosis of ADHD, "combined type."[13] These three types were later validated for

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children age 4 through 6 years, in cases where a structured diagnostic protocol was used.[4]

Perhaps one of the most helpful definitions came in 1990, when Barkley provided a conceptual definition of ADHD as a "developmental disorder characterized by inappropriate degrees of inattention, overactivity and impulsivity. These often arise in early childhood, are relatively chronic in nature, and are not readily accounted for on the basis of gross neurological, sensory, language, motor impairment, mental retardation, or severe emotional disturbance."[5(p65)] However, this condition continues to remain a challenge to diagnose, as it is frequently associated with other conditions such as anxiety disorders, bipolar disorders, and depression. In addition, at older ages there are other conditions that are frequently comorbid with ADHD (ie, learning disabilities, oppositional defiant behavior, and conduct disorder) that further complicate the diagnosis.

EARLY BEHAVIORAL OBSERVATIONS OF POSSIBLE ADHD SYMPTOMS

According to the criteria for ADHD in the DSM-IV, ADHD can be diagnosed in a child after the behavior has been present for a minimum of 6 months and the child demonstrates at least six or more of the specific behaviors for inattention or hyperactivity-impulsivity prior to the age of 7 years. Despite these specific requirements, few assessment measures exist that include ways to diagnose the condition in very young children. The few behavior rating scales that did include questions about ADHD-type behaviors were broad in nature, time consuming to complete, and not designed for use during actual observations. After reviewing measures and studies of ADHD in young children, and relating these to our own experiences, we determined that an easy-to-use, short observation scale was needed. We believed that one could reasonably observe the three key domains of behavior relevant to an ADHD diagnosis within the context of play in very young children. Specifically, these areas were: (1) how the child planned and approached interactions, (2) the activity level in executing actions, and (3) the attention and focus with which children engaged in interactions. These three domains were consistent with the three identified in scales that had been used for children as young as age 5 years.[6] We identified four behaviors within each of the three areas and formed subscales (overactivity, impulsivity, and inattention), named for the characteristic of ADHD with which they were associated. The final version of the scale, named the Attention Deficit Hyperactivity Disorder–Observation Rating Scale,[7] consisted of 12 items, each of which was scored on a 5-point Likert scale. The scale ranged from very limited or not present to behavior that was excessive or clearly exceeded that which was typical for the chronologic age of the child whose behavior was being observed.

Following scale development it was important to field test the scale and determine whether the behaviors, now incorporated into 12 items, could be used with a very young population. Because of previous association with The Infant Health and Development Program[8] we had access to archived data and videotapes of over 700 low-birth-weight children who were born prematurely. The videotapes included an 8-minute segment in which mothers played with their 30-month-old children. We determined through careful investigation that these short video segments were sufficient for use with the new scale. Our findings[7] upheld the three subscales named above; however, a factor analysis suggested that some items were actually more congruent with other domains.

Further research on our observational tool pointed to six key items, all of which loaded on the inattention factor. The extremes of these behaviors, listed in Table 1, could serve as early warning signs in children under age 5 years of who may be diagnosed with ADHD at a later age. It is important to examine these items carefully, as in our view hyperactivity and impulsivity at this young age are embedded in the items in Table 1 even though they loaded on the factor we have labeled "inattention." Thus, our results are not inconsistent with previous reports that found that a high activity level, rather than inattention, is the symptom most noticeable in preschool-age children.[9]

Table 1. Early signs of possible ADHD

- Acts before thinking
- Changes activities frequently
- Has a short attention span
- Fails to focus and follow directions
- Distracts easily
- Has difficulty staying on task

ADDRESSING EARLY SIGNS OF ADHD-TYPE BEHAVIORS AND MAKING REFERRALS

Early childhood professionals are in a unique position to help families obtain proper diagnoses at earlier ages before the harmful effects of ADHD-type behaviors influence learning, family harmony, and self-concept. Excessive levels of ADHD-type behaviors impede developmentally appropriate socialization, optimal learning, and positive parent-child interactions. However, environmental events, inadequate parenting skills, and other diagnoses (eg, anxiety or mood disorders and oppositional defiant disorders) can lead to behaviors that mimic ADHD. In addition, the child can carry one of these diagnoses and the ADHD is not recognized as problematic.[10] Yet, all young children are active, impulsive, and inattentive at times. The difficulty comes in ascertaining when these behaviors are out of the ordinary and creating a handicapping condition. In addition, each case of ADHD can be unique, with behaviors varying from child to child.

For these reasons, it is critical for early childhood education and therapy providers to refrain from overreacting and viewing each child who is easily distracted, runs around, fails to listen, and so forth as a potential candidate. Responses or the lack of response to these negative behaviors often unintentionally reinforce the conduct and result in undesirable learned behaviors. When environments and expectations are not developmentally appropriate or when behavioral expectations are inconsistent and tolerated in one situation and not another, then ADHD-type behaviors can become common, learned responses. Even though the child may exhibit these ADHD-type behaviors, true ADHD may not be present.

The ability to discern when behavior is extraordinary and needs to be addressed either through a referral or through some kind of immediate intervention is an important skill for early childhood providers. When a child demonstrates an inability to sustain attention, to respond with thought, and to move purposefully, professionals should take notice. Because ADHD is a medical diagnosis, many child care professionals will be faced with a decision as to whether referral is warranted. There is no test for ADHD; the diagnosis is a clinical judgment. Therefore, evaluation of children suspected of having ADHD needs to be a multistep, multidisciplinary process. A diagnosis should be based on a complete medical examination and history, information gathered via interviews with a number of persons who know the child, observations made in different naturalistic settings at different times, and scores on parent and teacher rating scales. This is where professional care providers can help.

Early childhood professionals should document over time, and in different situations, behaviors of concern. It is important to keep in mind that the behaviors are not creating a problem unless they are handicapping the child by interfering with his or her cognitive, social, or emotional development. Then, it is appropriate and necessary not to wait, but to speak with the family. If they share similar concerns and have noticed the same type of behaviors at home, then the child care professional should suggest that the family speak to the child's pediatrician or perhaps a child psychiatrist. Table 2 provides some guidelines to help child care professionals make referral decisions.

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Table 2. Referral guidelines for possible ADHD

Refer when behavior . . .	Wait and watch when behavior . . .
has been observed for at least 6 months	is recent and inconsistent
is a problem in several settings	appears at a single place or time
occurs during independent and group activities	occurs primarily during group times when prolonged sitting is required
cannot be explained by other circumstances or disabilities	could be the result of recent life events
interferes with learning	indicates child is acquiring skills
affects peer relationships and social development	demonstrates appropriate friendships and interactions
is inappropriate despite clear, consistent age-appropriate expectations	varies in the presence of different adults in the child's life
appears out of the child's control	appears purposeful or attention getting

INTERVENTIONS AND TREATMENTS OF ADHD

Preschool-age children are infrequently diagnosed with ADHD and interventions are seldom offered. To look for intervention and treatment strategies, it is helpful to turn to what has been tried with young school-age children. Interventions and treatments for ADHD in this population have included various psychotropic medications, psychosocial strategies, dietary management, herbal and homeopathic treatments, biofeedback, and sensory-perceptual stimulation techniques. Of these, the first two are prescribed most often and have been subjected to more substantive research.

Common psychotropic interventions

Medication therapy for children with ADHD involves the intake of a substance that alters brain chemistry and thereby changes the outward behavior of the affected child. By far the most commonly administered medications are stimulants. It seems incongruous to many that children with problems that include hyperactivity are prescribed stimulant drugs such as Ritalin and Dexedrine. These psychostimulant drugs are given because the drugs are thought to alter the neurotransmitter functioning in the frontal area of the brain, the area responsible for inhibiting behavior and attending to tasks. Thus, children taking these drugs will be able to attend to a task for a longer period of time and will focus better. Research investigations of psychotropic medications have supported the effectiveness of methylphenidate (MPH), dextroamphetamine, and pemoline in children with ADHD.[14] It is estimated that between 70% and 90% of children will have a positive response to one of the major stimulants when it is first prescribed.[15]

While there is extensive research on the use of medications in school-age children, there remains a paucity of research on the use of drugs with young children. Investigators[16] have reported that children who received methylphenidate benefited from this medication. Barkley suggested stimulants increase the "braking power of the brain over behavior."[17(p60)] We now have a better understanding of how Ritalin works in the brain; it significantly increases extracellular dopamine levels.[18] Since dopamine is known to activate motivation and drive, increasing it could explain the improvement in attention seen in children taking this drug. Table 3 provides an overview of three commonly used

Table 3. Common medications and effects

Medication drug class (Trade names)	Effects
Methylphenidate (Ritalin)	A mild stimulant of the central nervous system (CNS) that increases the child's alertness and on-task behavior while decreasing impulsivity, overactivity, and distractibility; improvements are reported in short-term learning in academic areas and in social skills. Ritalin is rapidly absorbed and clinical effects wear off after 4 hours; therefore, it may not last through the school day. A long-lasting form of this medication is used in some cases. There have been some negative reports of the impact of the drug on weight gain and growth. Ritalin is prescribed in about 80% of cases and is reported to be beneficial in improving behavior. This drug has not been approved for children under the age of 6 years, however; trials are underway.
Amphetamines (dextroamphetamine (Dexedrine)	Increases ability to attend to specific activities and reduces hyperactivity; not recommended for children ages 5 to 6 years. It is available in a sustained-release form that lasts 6–8 hours. It is a legally controlled substance that has been abused among school-age children. It can be associated with appetite suppression and insomnia. It is a mild anticonvulsant that has been used concomitantly with seizure disorder.
Pemoline (Cylert)	CNS stimulant that increases attention to tasks, social skills, and intellectual functioning and decreases motor activity. A single dose will last 12 hours. A concern with this drug is liver toxicity and, to some extent, insomnia and anorexia. It is less frequently used than Dexedrine and Ritalin.
d Amphetamine (Adderall)	A recent, well-controlled investigation[19] compared Adderall with Ritalin and concluded that Adderall was at least as effective as Ritalin in improving acutely the behavior and academic performance of children with ADHD; there were no additional side effects. Two doses of Adderall produced consistently higher effect sizes than the two doses of Ritalin, and clinical recommendations made by both open- and blinded staff were more likely to favor Adderall over Ritalin.

medications for children with ADHD. One additional drug, Adderall, was included due to some relatively new findings of the drug when compared with Ritalin.

Perhaps the most important study of treatment practices for children with ADHD was conducted over a 14-month period at six sites in the United States, with children age 7 to 9.9 years.[19] This randomized clinical trial examined the effects of four treatment groups: medication management followed by monthly visits, intensive behavioral treatment, a combined medication/behavioral treatment group, and a standard care offered by community providers. Assessments across multiple domains occurred throughout phases of the investigation. Investigators reported reductions in the symptoms of ADHD over time in all four groups, with significant differences across the groups in degrees of change. The children in the medication management and the combined medication/behavioral treatment groups showed significantly greater improvement than those given behavioral treatment and community care. The combined treatment group did not differ significantly from the medication management group on core ADHD symptoms; however, for non-ADHD symptoms of

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oppositional/aggressive behavior, internalizing behavior, teacher-rated social skills, parent-child relations, and reading achievement, the combined treatment group offered greater benefits.

Psychosocial strategies for children with early signs of ADHD

A major responsibility of early childhood professionals is to recognize child behavior that is possibly delayed or abnormal. Parents and professionals will then meet to discuss the problem and determine whether or not it is a mutual concern. This could confirm or question whether the behavior should be brought to the attention of the child's pediatrician. However, regardless of whether the parent takes the child for an evaluation, it is likely that the parents and professional will want to implement some strategies to address the behaviors. Researchers in the large Multimodal Treatment Study of Children with ADHD (MTA) concluded that "behavioral treatments may help families actively cope with their child's disorder and make the necessary life accommodations to optimize family functioning, even when such treatments are not as effective as medication in reducing children's ADHD symptoms."[26(p1094)] Further support for parent-based therapies for preschool children with ADHD was reported in an investigation of two different models for such services. A parent training model and a parent counseling and support model plus a wait list control group were compared. ADHD symptoms were reduced, moreover, parent training, when compared with the other two groups, increased mothers' sense of well-being. In addition, 53% of the children whose parents received the training also displayed clinically significant improvement.[26]

The earlier behaviors are identified and interventions are implemented, the more likely the behavior can be modified before it becomes a more serious barrier to learning. The aim is to redirect children on the preferred developmental trajectory. A common plan is for professionals and families to agree on some strategies. Some will be structural and address environmental arrangements; others will offer suggestions for adults in interactions with the child. Environments that can individualize and adapt routines and practices to make experiences more positive for the child's development are highly desired. When environments provide developmentally appropriate and meaningful activities, they invite the child's active involvement. Adults have numerous opportunities each day to influence the child's behavior in positive and constructive ways through their responses to the child's initiations. Among the strategies that facilitate the acquisition of appropriate behavior are clear and consistent expectations, directions, and follow-through. The adult can shape interaction by modifying his or her pace and intensity to encourage a calmer, more attentive atmosphere. Timely implementation of principles of behavior management, such as time-out to regain thoughts and composure, is sometimes helpful. These kinds of environments and interactions will help foster the development of a more positive self-concept in the child. Table 4 includes a more complete list of suggested strategies.

Table 4. Coping with ADHD: Strategies for home and school

- View the child as a good child with a special need.
- Remember that the child's misbehavior is organic in nature.
- Capitalize on the child's strengths and emphasize the positive.
- Provide a special time for the child each day.
- Plan ahead when introducing new concepts and for challenging situations.
- Reduce environmental distractions and be an alert listener.
- Establish clear rules and apply them consistently.
- Ensure that adults support the rules.
- Secure eye contact before giving directions.
- Give clear, simple, straightforward directions.
- Check child's understanding of directions and the consequences of failing to follow them.
- Be patient and low key, but firm.
- Act, don't over talk.
- Refrain from being drawn into debates or arguments.
- Use good and consistent behavior management techniques.
- Understand and use time-outs if the results are effective.
- Give positive feedback and praise frequently and quickly after appropriate behavior.
- Help the child recognize his or her own strengths and accomplishments.

CONCLUSION

In summary, it is critical to pay more attention to preschoolers in order to identify those externalizing behaviors, distinguishing features, and interactions that are reliable predictors for a future ADHD diagnosis. The needs are present when children are very young, but professionals have been reluctant to refer at young ages. By delaying this process, problems exacerbate and undesirable behaviors become learned. The earlier the recognition of a problem, the sooner appropriate interventions, treatments, and counseling can begin to counter the negative effects of family stress, lowered self-esteem, and ensuing learning and social difficulties. Regardless of a clear diagnosis, professionals can provide support to the families as they address the behaviors that are causing concerns. It is quite possible that some environmental changes can be made that can impact and redirect behavior in more productive ways. Continued research certainly needs to be conducted to further understanding of this handicapping disorder. Hopefully, more support for such research will be forthcoming, and more collaboration between academicians, the medical profession, and professionals in the field of early childhood development will result.

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THE DEVELOPMENT AND USE OF THE ATTENTION DEFICIT HYPERACTIVITY DISORDER-OBSERVATIONAL RATING SCALE: FACTOR ANALYSIS AND A PRELIMINARY INVESTIGATION OF PREDICTIVE VALIDITY

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The Attention Deficit Hyperactivity Disorder-Observational Rating Scale (ADHD-ORS; Deutscher & Fewell, 1996) was developed and used to rate 702 videotapes of 30-month-old, premature, low-birthweight toddlers born at eight medical schools across the nation. Coders were trained to score the 12-item scale according to specific criteria for each of 5 points on the Likert scale. Scores were subjected to a principal components factor analysis with varimax and promax rotations. The results support three factors that closely match the three main attributes of the disorder. These factors were identified as inattention, overactivity, and impulsivity. Six-month predictive validity with selected items from the Child Behavior Checklist was also determined. Implications for use in preschool settings and directions for future research are considered.

Attention Deficit Hyperactivity Disorder (ADHD) has become one of the most prevalent neurobehavioral disorders affecting children in this country. The United States Department of Education suggests that 3% to 5% of school-aged children, perhaps as many as 2,000,000, have significant educational problems because of ADHD that often continue into adolescence and adulthood (Aleman, 1991). The number of children being diagnosed with ADHD and concerns about how to intervene continue to escalate. Visits to pediatricians' offices due to attention deficit and hyperactivity problems have increased from 1.4% of visits in 1979 to 9.2% in 1996 (Kelleher, McInery, Gardner, Childs, & Wasserman, 2000). This problem has been further exemplified by the recent report on the dramatic increase in the use of psychotropic medication for preschoolers between 1991 and 1995 (Zito, Safer, dosReis, Gardner, Boles, & Lynch, 2000). As the National Institutes of Health (NIH) Consensus Statement 110 concludes, ADHD is a major public health problem (NIH, 1998).

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Although the disorder was first described in the early 1900s (Still, 1902), it has been referred to by various names over the years; terminology has ranged from minimal brain damaged to hyperkinetic impulse disorder to hyperactive child syndrome to attention deficit disorder with and without hyperactivity to the present terminology of ADHD. Only in the last decade has a conceptual, consensus definition been reached and that was described by Barkley (1990) as "...a developmental disorder characterized by developmentally inappropriate degrees of inattention, overactivity, and impulsivity. These often arise in early childhood; are relatively chronic in nature; and are not readily accounted for on the basis of gross neurological, sensory, language, or motor impairment, mental retardation, or severe emotional disturbance" (p. 47). The current, clinical definition approved by the American Psychiatric Association in the 4th edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*, 1994) has evolved to indicate that the essential feature of ADHD "...is a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals at a comparable level of development" (p. 78). Yet, even today the precise diagnosis of ADHD remains a challenge because there are so many disorders with overlapping symptoms that may mimic characteristics of ADHD, such as anxiety disorders, bipolar disorder, multiplex developmental disorder, depression, and manic depressive illness. In addition, at a later age there are the comorbid disorders such as learning disabilities, oppositional defiant behavior, conduct disorder, and serious emotional behavior that also make a definitive diagnosis complex.

Although it is known that children as young as 3 years old exhibit symptoms of overactivity, impulsivity, and inattentiveness (Barkley, Fischer, Edelbrock, & Smallish, 1989; Campbell, 1987; McKinney, Montague, & Hocutt, 1993), the diagnosis of ADHD is most frequently made after children enter elementary school, and then it is usually not until second grade. Although the research is sparse, there is evidence to support the continuity of these problem behaviors from the preschool years into the early childhood years (Campbell, Breaux, Ewing, & Szumowski, 1986; Campbell & Ewing, 1990; Campbell, Pierce, March, Ewing, & Szumowski, 1994; Orney, Uriel, & Tannenbaum, 1992; Palfrey, Levine, Walker, & Sullivan, 1985; Sanson, Smart, Prior, & Oberklaid, 1993). Clearly, these behaviors arise during the early years, as required for a diagnosis, but little research has been done involving children under the age of 3 years. Given the long-term outcomes associated with ADHD with respect to school failure and poor social outcome, the importance of early identification and intervention is evident.

Today especially, with the research that has been done on school-aged children and the expanding insight psychologists and others have regarding early social-emotional and behavioral development in infants and toddlers, it should be possible to conceptualize a model of ADHD behaviors in children under the age of 3 years. Unfortunately, as noted, few studies have investigated ADHD-type behaviors at this younger age, and few scales can be found to help screen for or identify the specific behaviors. With the increase in the numbers of parents of very young children in the workforce, there has been a significant increase in enrollment in child-care centers where staff may observe the early signs of ADHD-type behaviors. Therefore, there is a growing need for a mea-

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sure that might screen for ADHD at very young ages. When staffed with persons knowledgeable in the early signs of ADHD-type behaviors, child-care settings provide an opportunity for screenings and subsequent referrals for early diagnosis and appropriate interventions.

To understand the conceptual basis of ADHD in children under the age of 3 years upon which an observational measure might be based, we undertook an extensive review of the literature and examined scales currently in use that identify behaviors relevant to an ADHD diagnosis. Scales to assess ADHD in children above the age of 6 years (i.e., usually 6 to 16 years) consider three main features of ADHD—hyperactivity, impulsivity, and inattention. An excellent review of these scales can be found in *Attention Deficit Hyperactivity Disorder* (Barkley, 1990). The specific scales reviewed for use with children aged 5 and under are included in the Appendix (see pp. 330–333). The review includes the instrument, age range, time to administer, informant, a brief description, and the psychometric properties.

Behavior scales do have the advantage of providing an inexpensive and quick way to gather information from significant informants. However, some serious concerns were identified with the content and administrative aspects of the available scales as well as behavior scales in general, particularly as they would apply to very young children. Most scales that were available relied on information gathered on questionnaires completed by an adult who knows the child. The instructions one gives to the adults, as described in the scale manuals, provide little information as to the meaning of the ratings or any training that should precede scale completion. Informants not having the same perceptions with regard to anchor points of the scale such as "sometimes" and "always" can result in lack of agreement between individuals who rate the behaviors of the same child. Also, informants' responses and understandings of the behaviors to be rated may be influenced by such factors as their own intelligence and emotional status (Barkley, 1990; Bracken, 2000; Conners, 1998). Some of the scales were cumbersome to use because of their length. Additionally, few scale authors reported data on their psychometric properties. Finally, the rating scales failed to contain real-life observations of child behavior, such that might be used by staff in child-care and natural settings. Given the nature of ADHD and the importance of early identification when intervention might be more effective, we determined that there was a need for a quick, easy-to-administer, observational screening scale that could be used in child-care and similar settings.

The objective of this paper is to describe the development of the Attention Deficit Hyperactivity Disorder-Observational Rating Scale (ADHD-ORS) and report results of a preliminary investigation of its predictive validity. More specifically, three basic research questions about the measure were asked.

1. Can coders obtain acceptable rates of interrater reliability when scoring scale items?
2. Can a factor structure be derived that is consistent with the theoretical constructs of ADHD, thus giving the measure construct validity?
3. Do the subscale scores derived from the factor structure predict scores on selected items of a measure respected by the field that is similar in construct to the one used?

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METHOD

Study Background

The investigators had access to the extensive database of the Infant Health and Development Program (IHDP, 1990) and to the set of videotapes made as part of an ancillary study. These videotapes, made when the children were 30 months of age, and measures given at age 3 years are the basis for this study. Therefore, it is appropriate here to provide a brief overview of the original study and the subjects.

Infant Health and Development Program. The IHDP used eight sites and randomized clinical trials to evaluate the efficacy of an intensive, comprehensive early intervention for low-birthweight (≤ 2500 g), premature infants (≤ 37 weeks gestational age). The eight sites were the University of Arkansas, Albert Einstein College of Medicine, Harvard University, University of Miami, University of Pennsylvania, University of Texas, University of Washington, and Yale University. A sample of 985 infants born at these participating centers constituted the primary research sample. The research design included stratification by eight sites and into two birthweight groups. Two-thirds of the infants weighed <2000g (the lighter group) and one-third 2001g to 2500g (the heavier group). One-third of the infants were randomly assigned by computer into the intervention group (n = 377) and two-thirds were assigned to the follow-up only group (n = 608). Attrition was 7% at the 36-month assessment. A thorough coverage of the project can also be found in *Helping Low Birth Weight, Premature Babies: The Infant Health and Development Program* (Gross, Spiker, & Haynes, 1997).

Videotaping procedure. The major ancillary study of the IHDP involved videotaping mother-child interactions when the children were 30 months of age (Spiker, Fergerson, & Brooks-Gunn, 1993). The videotapes were approximately 25 minutes long and consisted of three separate segments: an 8-minute free play period, a clean-up period, and three problem-solving tasks. For the purpose of this study, only the 8-minute free play session was used to observe the children's behavior because ADHD behaviors are most often reported by parents as occurring when children are given freedom with choices of activities and when many options are present. Mothers were instructed to play with their children as if they had set aside a time just for them. Other than to speak to their children in the language normally used at home and to face the camera, no further instructions were given. All dyads were given the same instructions and the same set of toys. Toys consisted of a doll (race appropriate), bottle, blanket, box of blocks, telephone, set of dishes in a picnic basket, cars, plane, helicopter, airport, and play figurines. All toys were available to the children throughout the free play session.

Current Study Participants

Subjects for this investigation were drawn from the 713 IHDP mother-child dyads from the eight sites who consented to be videotaped. The final sample included 702 dyads; tapes were eliminated for the following reasons: (a) no translators were available for the languages in which the tapes were made (n = 5); (b) the child had a serious impairment that prevented an appropriate interaction for purposes of this investigation (n = 5); and (c) the adult in the

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tape was not the mother ($n = 1$). Of the participants in this study, 273 were from the intervention group and 429 were from the follow-up group. The mean birthweight of the participants was 1804g. Males accounted for 51.0% of the sample. Ethnicity representation was as follows: White = 38%, African American = 51%, and other = 11%. The mean age of the mothers in this sample was 25 years, with a range between 13 and 43 years. Preliminary analyses of the subsample and the original IHDP sample on sex, birthweight, and group assignment produced no statistically significant differences. Although ethnically this sample may not be representative of the general population, an aspect over which we had no control, it is representative of a premature, low-birthweight population.

Measures

Preliminary research. Prior to the actual work on the development of the scale, we identified four scale attributes that we wanted to include in the construction of any subsequent observational scale. First, items would need to describe behavior that was symptomatic of the assessed construct (in this case, ADHD), according to research and other sources. Second, items would need to be clearly defined and easy to observe so that observer reliability across raters could be assured. Third, the scale would need to be psychometrically sound. Finally, in order to be used as a screening tool, the scale would need to be designed for quick administration.

Four steps were taken to develop the observational scale. First, we completed a review of the literature, including the *DSM-IV* criteria and the consensus definition of ADHD. Second, we reviewed the scales described above. Third, we reflected upon our personal experiences with young children. Finally, we incorporated the information gathered and our experiences into a conceptual model of ADHD-type behavior in children under the age of 3 years. This resulted in the observational rating scale used in this investigation.

The conceptual model of ADHD for this scale reflects difficulty in three areas—hyperactivity, impulsivity, and inattention; these are often referred to as the "holy trinity" of ADHD (Barkley, 1990; p. 40). We concurred with the importance of these attributes and adopted these as representative of what could be conceived and observed as separate factors or subcategories of ADHD. Although *DSM-IV* describes impulsivity and hyperactivity as a single category (a change from *DSM-III* and *DSM-IIIR*), it was decided to look at hyperactive and impulsive behaviors as separate entities in the very young children we were observing. Since little research has been done with this age group, it was felt to be best to see whether either one of these two behaviors was easier to identify or more important.

Because the behaviors typically associated with these attributes are common to all young children, extreme care was taken not to overidentify behaviors that could or should be considered typical of normal 2½-year-old conduct. We made distinctions between those behaviors in 2-year-olds that appeared to be learned behaviors, actions associated with poor parenting, or simply the "terrible twos" and those that were more likely true ADHD-type symptoms. In addition, priority was given to the identification of those early behaviors that might predict a future diagnosis of ADHD.

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Attention Deficit Hyperactivity Disorder-Observational Rating Scale (ADHD-ORS). The work described led to the development of a scale of 12 items, 4 on each of the 3 subscales, that could be used to rate observations of ADHD-type behaviors in preschool-aged children (Deutscher & Fewell, 1996). Each of the 12 items was rated on a 1 through 5 Likert scale. The items and the identified three subscales were as follows. Items on the *overactivity subscale* were (a) always on the go; (b) moves fast; (c) restless, fidgets; (d) easily excited, talks excessively. Items on the *impulsivity subscale* included (a) can't wait, frustrates easily; (b) changes activities; (c) acts before thinking, rushes, careless; (d) blurts out, interrupts, loud, noisy. The *inattentiveness subscale* included (a) easily distracted; (b) doesn't focus to follow directions; (c) short attention span; (d) difficulty staying on task.

To address specificity, subjectivity, bias, and interpretation errors, and to ensure high rater reliability, descriptors for each of the 12 items were developed. For each behavior, we prepared descriptors of the 5 ratings, which ranged from very limited or no presence of the behavior to observations of the behavior that clearly exceeded what was normal for the chronological age of the children who would be included in the sample to be rated. Furthermore, the higher scores of "4" and "5" on items would enable the examiners to distinguish preschool children exhibiting behaviors that may be predictive of ADHD from those who do not display these behaviors. The average rating of "3" described behavior that would normally be expected of a child of that age in that circumstance and included a wide range of what was considered appropriate. A rating of "2" described behavior that was less active, impulsive, and inattentive than most children of that age in that situation. A rating of "1" described what would be expected when the behavior was not present or was rarely exhibited. Because this scale assesses externalizing behavior, a "1" was not meant to be the opposite of extreme ADHD behavior that could be looked at as internalizing disorders such as depression. Ratings of "1" across all items might be indicative of some pathology, and further evaluation might be prudent. An illustration of the type of descriptors provided for each of the 12 items is presented below for the item, "easily distracted":

Rating of 1: Child is not distracted by other stimuli; able to refocus if interrupted.

Rating of 2: Child is not easily distracted or led astray.

Rating of 3: Child is not too easily side-tracked; if distracted, can be easily refocused with prompting.

Rating of 4: Child is easily distracted by extraneous stimuli; could be difficult to refocus.

Rating of 5: Child is highly distracted by extraneous stimuli; very difficult to refocus.

ADHD-ORS scale training. Coder A (a scale developer) trained two coders (B & C), who were graduate students, to rate behavior observed during play. Extensive training of over 30 hours was conducted using videotapes made of twin siblings of participants (and not part of the IHDP) so they were identical to the study videotapes. As part of the scale training, background on ADHD and many examples of behaviors typical of the five ratings for each item (see above) were illustrated and discussed. Coders were also trained to separate

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developmentally appropriate behavior from excessive and inappropriate displays. When coding inattentive behaviors, coders were trained to observe the child's ability to listen attentively, focus, stay with a task until completion, and not be distracted. Coders were trained to consider intensity, frequency, and duration when making overactivity ratings. When coding impulsive behaviors, coders were trained to take into account the child's ability to inhibit responses, wait, and delay actions. Videotapes were viewed, rated independently, and then disagreements discussed until consensus was reached. Training continued until agreement of Coders B and C within 1 point of the score of Coder A was established for each of the variables on the ADHD-ORS.

Interrater reliability. To calculate interrater reliability on the training, a random sample of 25 twin tapes (not used in prior training) from the eight sites was selected and rated independently by the three coders. Reliability was determined based upon the percentage of interrater agreement: (number of agreements/number of agreements + disagreements) x 100. Interrater agreement for Coder B (with Coder A) within 1 point and across all 12 items averaged 99%, with a range from 95% to 100%. Interrater exact agreements ranged from 84% to 95%, with a mean of 89%. Interrater agreement within 1 point across categories for Coder C (with Coder A) averaged 100%, with a range from 98% to 100% across all items. Interrater exact agreements ranged from 80% to 95%, with a mean of 89%. All percentage agreements are above the generally accepted level of 80% (Gelfand & Hartman, 1975).

Child Behavior Checklist for Ages 2-3 (CBCL). The CBCL (Achenbach, Edelbrock, & Howell, 1987) is a 99-item scale that is completed by a parent, teacher, or person who is very familiar with the child. Each item is scored on a three-point Likert scale (0 = *not true*, 1 = *somewhat or sometimes true*, 2 = *very true or often true*). Higher scores on the scale indicated more behavior problems. Mothers were read selected items by IHDP interviewers to control for possible differences in reading ability. Checklist items were also completed at 36 months of age by the child's teacher and the teacher's aide.

Because the CBCL is a rating scale that rates both internalizing and externalizing behaviors, such as social withdrawal, depression, sleep and somatic problems, and aggressive and destructive behavior, it was decided to select from the 99 items only those that were felt to exemplify the construct of ADHD since that was our specific focus (McConnaughy & Achenbach, 1988). For this study, 7 items that targeted ADHD-type behaviors were selected for use in data analyses. By collapsing the scores, a new variable (CBCL/ADHD) was created. This variable was the sum of items on the CBCL that specifically addressed the ADHD-type behaviors that could be observed in toddlers. The 7 items included from the 36-month parent and teacher CBCL were as follows: child can't concentrate, child can't sit still, child can't stand waiting, child is easily frustrated, child gets into everything, child quickly shifts activities, and child is unusually loud.

Procedure and Data Analysis

Once the training was completed, procedures for coding the tapes to be used in the study were implemented. Tapes were balanced for site and for treatment group and randomly assigned to the coders. Coders were blind to group

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MAY-8-2002 11:47A FROM: TO:919199667463350802 4 P:10

assignment as well as to all other initial characteristics of the participants not apparent from the coding (i.e., gender and race). Reliability was determined as described previously. To assess reliability, 15% of Coders B and C's tapes were independently rated by Coder A (also the scale developer). The coders were blind to assignment of the dually rated tapes, which were balanced across site and treatment group. Interrater reliability regarding exact agreements, agreements within 1 point, and means were determined. Drift reliability was determined throughout the coding period for each coder as each site was completed. Any discrepancies were discussed before proceeding to the next site. Reliability was calculated using the initial codes, but the agreed-upon data were entered into the database for analysis.

The second procedure was to complete a factor analysis on the ADHD-ORS. We adopted a common rule to accept as many factors as there were eigenvalues larger than 1 in the initial statistics (Guttman, 1954). To determine how the items on the ADHD-ORS clustered into factors, exploratory factor analyses using principal components with varimax rotations (with one, two, and three factors) were utilized. The orthogonal factor structure was not readily interpretable. This suggested the need to conduct an oblique rotation in order to achieve simple structure (Hetzel, 1996). Promax rotation was selected for this purpose, and simple structure was achieved.

Our third procedure was to use a Pearson correlation analysis to determine if the ADHD-ORS correlated with similar items on the Child Behavior Checklist Ages 2-3, which was rated by the parents, teachers, and teacher aides of the same children when they were 36 months old. All subject data were combined for purposes of analyses in this investigation in order to maximize power for scale development. In contrast to the IHDP, the roles of intervention, birthweight, and sex were not a focus of the investigation; therefore, there were no group comparisons.

RESULTS

Interrater Reliability

Investigations of scale development include research on the use of the measure across examiners. For Coder B, exact reliability across all eight sites averaged 87% (range = 82% to 91%). Reliability within 1 averaged 99% (range = 97% to 100%). For Coder C, exact reliability across sites averaged 90% (range = 83% to 98%). Reliability within 1 averaged 100%.

Factor Structure

The promax rotation produced the best simple structure. Items for each of the three factors and their respective pattern coefficients are shown in Table 1. Both pattern and structure coefficients are reported because the factors were rotated obliquely and thus are correlated (Thompson & Daniel, 1996). The first factor was represented by 6 items with an average factor pattern coefficient of 0.80 (range = 0.68 to 0.91). A review of the items comprising the first factor, which consisted of the 4 items of the inattentiveness subscale plus 2 items from the impulsivity subscale, confirmed that they were indeed measuring inattentive behaviors. Thus, Factor 1 retained the label Inattentiveness. The second

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MAY-8-2002 11:48A FROM: TO:919199667463350802A P:11

factor was represented by 3 items with an average factor pattern coefficient of 0.74 (range = 0.53 to 0.86). A review of items comprising the second factor suggested that these items were measuring uninhibited behavior. Thus, the second factor was labeled Impulsivity. The third factor was represented by 3 items with an average factor pattern coefficient of 0.74 (range = 0.60 to 0.97). A review of items comprising the third factor suggested that these items were measuring mobile behavior. Thus, the third factor was labeled Overactivity. In general, the obtained factor structure was similar to that proposed by the scale authors and representative of the three attributes of ADHD.

Table 1
Promax Factor Analysis of the Attention Deficit Hyperactivity Disorder-Observational Rating Scale

	Item	Pattern Coefficients			Structure Coefficients		
		I	II	III	I	II	III
Inattention	Easily distracted	.79	.07	.02	.83	.39	.43
	Doesn't focus to follow directions	.72	.04	-.07	.70	.29	.29
	Short attention span	.91	.03	.09	.88	.35	.37
	Difficulty staying on task	.86	-.14	-.08	.84	.24	.44
Impulsivity	Can't wait, frustrates easily	.28	.53	-.12	.44	.59	.26
	Changes activities	.84	.01	.06	.87	.37	.47
	Acts before thinking, rushes, careless	.68	.07	.16	.78	.41	.52
	Blurts out, interrupts, loud, noisy	.00	.82	.00	.33	.83	.38
Overactivity	Always on the go	.27	.11	.60	.61	.48	.78
	Moves fast	-.00	.32	.62	.43	.60	.77
	Restless, fidgets	-.05	-.14	.97	.36	.27	.88
	Easily excited, talks excessively	-.10	.86	.06	.27	.85	.39
Eigenvalues		2.92	1.42	1.21	5.10	3.14	3.43
% of variance		24.39	11.87	10.11	42.53	26.23	28.61

The variance explained by each factor eliminating other factors was 46.4%. Factor 1 (Inattentiveness) accounted for 24.4%; Factor 2 (Impulsivity) accounted for 11.9%; Factor 3 (Overactivity) accounted for 10.1%. The variance explained by each factor ignoring other factors was 97.3%. Factor 1 (Inattentiveness) accounted for 42.5%; Factor 2 (Impulsivity) accounted for 26.2%; Factor 3 (Overactivity) accounted for 28.6%. Internal consistency reliability for the entire scale using Cronbach's coefficient alpha for both raw and standardized variables was .90.

Predictive Validity

As can be seen in Table 2, the Pearson correlations between the ADHD-ORS factor scores and the parent, teacher, and teacher-aide CBCL scores at 36 months are all significant, although modest. Of the three factors, inattentiveness shows the strongest relationship to the perceptions of those who know the children well. Note that at 36 months the number of subjects for the teacher and the teacher-aide CBCL (n = 227) is much lower than the parent CBCL (n = 680). This is due to the fact that the follow-up group of the IHDP did not have center-based classes; only children in the intervention group had teachers and teacher aides.

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MAY-8-2002 11:48A FROM: TO:9191996674633508024 P:12

Table 2
Correlation for the ADHD-ORS Factors at 30 months and the CBCL at 36 months: Parent, Teacher, and Teacher Aide

CBCL	*n*	ADHD-ORS Factors Inattentiveness	Impulsivity	Overactivity
Parent	680	.25***	.10*	.2**
Teacher	227	.26***	.15*	.19**
Teacher Aide	227	.26***	.19**	.24***

Note.—Significance levels based on two-tailed tests
*$p < .05$ **$p < .01$ ***$p < .001$

DISCUSSION

This study addressed three questions in relation to the development of a new rating scale designed to be used in observing the early behaviors of children that might be indicative of those thought to be associated with later diagnoses of ADHD in children. In the first analysis, we examined coder reliability to determine whether the scale scores for the items were clear and discrete to the point that coders could distinguish the five scores across the behavioral spectrum. The interrater reliability ratings were high, with exact reliabilities of coders at 87% and 90%, and within 1 score reliability of 99% and 100%. It must be noted, however, that considerable training took place prior to this investigation; therefore, future coders without the lengthy training may not be as reliable. Nonetheless, these scores suggest that the 5-point criteria are discrete and trained observers can distinguish between the various scores. Therefore, there is preliminary evidence that the ADHD-ORS can be used reliably.

The second question related to the conceptual model proposed for the scale. More specifically, we hypothesized a three-factor model, based on behaviors identified in older children. Through the use of a promax rotation, a simple factor structure that fits the proposed conceptual framework was derived, suggesting that the scale has a useful factor structure. A review of the items that loaded on the factors justified the continued use of inattentiveness, impulsivity, and overactivity as labels for the behaviors. These factors explained adequate variance in behaviors consistent with the theoretical construct of ADHD.

The third and final question addressed the predictive validity of the three factors. Specifically, how well did the factors predict selected items from the CBCL, a well-respected rating scale that had been scored by parents, teachers, and teacher aides? The correlations obtained with each factor across all three rating groups (i.e., parents, teachers, and teacher aides) were small but statistically significant. A word of caution: although the correlations for Factors 2 and 3 (impulsivity and overactivity) were significant, they are of little clinical value. The highest correlations were found in the inattentiveness factor, which is not surprising considering the item loadings. A cursory review of the items that load on this factor suggests that it is quite comprehensive and may represent a broader behavioral perspective, at least at the screening level. At this young age, activity and impulsivity are embedded in the items that load on this factor. The fact that the inattentiveness factor is most predictive supports the finding reported in the Achenbach, Conners, Quay (ACQ) Project of the

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American Psychological Foundation, a definitive national study on rating scales (Conners, 1998). Achenbach, Conners, and Quay had originally hypothesized 12 syndromes based on previous factor-analytic studies. The expected factors of ADD with and without hyperactivity did not appear. The attention factor included a mixture of immature behavior, poor concentration, impulsivity, restlessness, and poor schoolwork. These are similar to the behaviors we observed at 30 months (minus the poor schoolwork) that made up the inattentiveness factor of the ADHD-ORS.

In conclusion, these data suggest that the ADHD-ORS when used with low-birthweight, premature toddlers as young as 30 months can distinguish between those with ADHD-type behaviors and those who do not exhibit such behaviors. Children who scored high on the ADHD-ORS at 30 months were rated high by parents and teachers 6 months later on selected CBCL items. These results provide support for the reliability and validity of the ADHD-ORS data. The ability of trained observers to use this simple scale looks promising for its use as a screening measure for young children who could benefit from further evaluation.

Limitations

In evaluating the results of this preliminary investigation, several limitations need to be noted. First, the fact that the videotapes that were available to us were not of a general population but of a group at higher risk for problems was both an advantage and a limitation in this study. Very low birthweight, premature children are at increased risk of psychiatric symptoms, especially ADHD (Botting, Powls, Cooke & Marlow, 1997; Cherkes-Julkowski, 1998). Thus, we anticipated that we would have the opportunity to view more examples of children who would exhibit ADHD-type behaviors. On the other hand, we cannot at this time generalize our results to the population overall. A similar caution needs to be made regarding the restricted age of the sample. Because all the children were videotaped at 30 months of age, it again limits our population generalization and we are unable to determine whether a broader age range would have produced more variation in scores or a different focus for the items scored. Second, the videotapes used in this study were not specifically designed for evoking or identifying ADHD behavior; thus, they may not have been ideal. Third, the behavioral sample was quite brief, only 8 minutes, and only in one laboratory setting. It could be that a longer sample would be more likely to contain examples of the behaviors thought to be associated with ADHD and produce different results. Likewise, a home environment or a venue more familiar to the family might have produced different interactions. Even though only an 8-minute videotaped sampling of a child's behavior when playing with their mother was viewed, it was thought that the advantage of seeing 702 dyads of varied ethnic and social backgrounds in standardized settings was compelling enough to offset these weaknesses. Moreover, the ratings were not being used to make a diagnosis but to ascertain if trained coders could use this 12-item observational scale to identify behaviors during a brief play session that would correlate with selected items from the CBCL.

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Future Research

Additional studies using this scale are needed with different populations, such as at-risk and normally developing preschoolers, and preschoolers of varying ages. It is possible that the factor structure might be different when the scale is used with these populations. More investigations using this scale that try to identify the various subtypes of ADHD in young children would also add to the field. Investigations into the relationships between this scale and others in the field would add to our understanding of the possible contributions of this scale. In addition, replication of this study to the full CBCL and using just the shorter 6-item inattentiveness factor should be pursued. Furthermore, future field-testing of the scale in vivo in preschools, day-care centers, and pediatrician offices would help confirm the usefulness of this scale as a screening tool. Following such a preschool sample into the public school system over time will allow for the examination of the practical application of this instrument by pediatricians, preschool teachers, or any professional working with young children. In summary, although this is a preliminary investigation into the use of a scale designed specifically for children under the age of 3, it looks promising as a reliable screening tool.

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Appendix
Scales with Age Ranges Including Younger Children

Instrument	Age	Time	Informant	Description	Psychometric Properties
Early Childhood Attention Deficit Evaluation Scale (EC-ADDES), 1995, Stephen B. McCarney	24 to 72 months	NA	Parent/ teacher	Verification of ADHD characteristic according to *DSM-IV* criteria	Only available through Hawthorne Educational Services, Inc.
Attention-Deficit/ Hyperactivity Disorder Test (ADHDT), 1995, James E. Gilliam	3 to 23 years	5 to 10 minutes	Parent/ professional	Designed to evaluate the behavior of persons with ADHD or behavior problems.	Highly standardized and normed on 2,696 children and young adults (1,279 had an ADHD diagnosis) from 47 states and Canada. Internal consistency is strong (<.90) with appropriately low SEM. Test-retest reliability is adequate to significantly strong. Construct and criterion validity confirmed.
Preschool and Kindergarten Behavior Scales (PKBS), 1994, Kenneth W. Merrell	3 to 6 years	8 to 12 minutes	Parent/ teacher	Designed to be used as a screening tool for early detection of social-emotional problems in young children.	Standardized on 2,855 subjects from 16 states. However, according to the review by C. Riccio (1995), there is an underrepresentation of Hispanics and an overrepresentation of Caucasians. Internal stability is very strong with subsequent low SEM. Test-retest reliability moderate to relatively strong—ranged at 3 weeks from .58 to .87 and at 3 months from .36 to .78. Interrater reliability weak to moderate—ranged from .36 to .63 between teachers and aides and from .13 to .57 between teacher and parent. Very strong evidence supporting the content and construct validity.
School Situations Questionnaire (SSQ), 1987, Russell Barkley	4 to 11 years	<5 minutes	Teacher	Designed to evaluate where children are exhibiting their problem behaviors (situational variation). Useful in designing behavioral interventions, and sensitive to effects of stimulant medication.	The revised scale, which is a more refined assessment of ADHD, begins at age 6. Normed on 615, 4- to 11-year-olds.

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MAY-8-2002 11:51A FROM: TO:9199667463350824 P:17

Home Situations Questionnaire (HSQ), 1987, Russell Barkley	4 to 18 years	<5 minutes	Parent	Designed to evaluate where children are exhibiting their problem behaviors (situational variation). Useful in designing behavioral interventions, and sensitive to effects of stimulant medication	Normed on 1,060 4- to 16-year-olds. The revised scale, which is a more refined assessment of ADHD, begins at age 6
Swanson, Nolan and Pelham Rating Scale (SNAP), 1988	Grades K to 5	<5 minutes	Teacher	Describes core symptoms of overactivity, inattention, impulsivity, as well as additional items describing peer-related aggression. Also designed to classify ADD with and without hyperactivity.	Has adequate psychometric properties. Test-retest reliability ranges from .66 to .92, with an average internal consistency of .90. The scale has also been evaluated for concurrent and discriminant validity. However, outdated for diagnostic purposes because of *DSM-III* revisions
The Yale Children's Inventory (YCI), 1986, Shaywitz, Schnell, Shaywitz and Fowle	Grades K to 4		Parent	Developed for the assessment of learning and behavior problems—scales reflect pure constructs of inattention, hyperactivity, and impulsivity. Developed to provide both a dimensional and categorical diagnosis of ADHD	Internal consistency reliability ranged from .72 to .93 across the 11 scales. Test-retest reliability ranged from .61 to .89. Interrater reliability available. Correlations of .53, .52, and .4 reported between YCI ratings of attention, impulsivity, and activity and the Conners Abbreviated Symptom Questionnaire
The ADD-H Comprehensive Teacher's Rating Scale (ACTeRS), 1984, Ullman, Sleator and Sprague	5 to 12 years	5 to 10 minutes	Teacher	Designed for diagnosing and monitoring the behavior of the child who manifests a deficit in attention in the classroom or is unusually active or restless. Also designed to monitor response to treatment	Normed on 1,347, 5- to12-year-olds (but they are not reported by age or sex). Test-retest eligibility ranged from .68 to .78, and interteacher agreement ranged from .53 to.73. Internal consistency coefficients were .93 to .97 for factor scores. Construct and discriminant validity are available, but concurrent validity has not been reported

MAY-8-2002 11:51A FROM: TO:9199667463350802 4 P:18

Child Behavior Checklist for Ages 2-3 and Ages 4-18 (CBCL; 1987, Thomas M Achenbach and Craig Edelbrock	2 forms 2 to 3 years and 4 to 18 years	15 to 20 minutes	Parent	An empirically designed standardized form to assess emotional/ behavioral problems (internalizing and externalizing) and competencies of very young children. Also available for 4 to18 range; teacher forms also available. Of the 99 items on the CBCL/2-3 scale, 59 were adapted from the CBCL/4 18 The scale yields 9 scores—a total sum score, 2 broad-band scores, and 6 narrow-band scores	Scales based on parent ratings of 546 children. Normed on 368 nonreferred children. (CBCL/4-18 based on parent ratings of 4,455 children. Normed on 2,368 nonreferred children.) Test retest reliability was .85 for the problem scales. Interparent agreement was .63 across the 9 problem scales at age 2 and .60 at age 3. Content validity supported by discriminating matched referred and nonreferred children. Construct validity supported by significant associations with the Richman.
Conners Parent Rating Scale Revised (CPRS-R); 1978, Goyette, Conners & Ulrich	3 to 17 years	5 to 10 minutes	Parent	Designed to evaluate the reported behavior problem of the child. Provides a brief evaluation of conduct problems or hyperactivity. There are 4 versions of the Conners including Teacher Scales.	Normed on 570 children aged 3 to 17 broken down by sex. Mother/father agreement ranged between .46 and .57. Parent/teacher agreement ranged between .33 and .45. Test-retest reliability NA. Validity not well established for this revision (though it is is for the older version).
Preschool Behavior Checklist (PBCL); 1988, McGuire and Richman	2 to 5 years	8 to 10 minutes	Parent	Designed to identify behavioral and emotional problems in preschoolers. This is a checklist assessing 12 areas of behavior with 22 items yielding one total score.	Data on norms NA. Agreements between psychiatric judgments and PBCL scores on 122 children was 81%. 73 scores correlated with the PBQ yielded a Pearson product moment correlation of .89 ($p < .001$). Interrater reliability studies revealed 83% agreement (Pearson $r = .68$, $n = 108$, $p < .001$). Test retest reliability was .88. Measures of internal consistency were .83.

MAY-8-2002 11:51A FROM:

Preschool Behavior Questionnaire (PBQ), 1974. Lenore B. Behar and Samuel Stringfield	3 to 6 years	5 to 10 minutes	Teacher	Screens preschool children for symptoms indicating behavior problems for further assessment. The scale differentiates hyperactive and normal preschoolers (Campbell et al., 1982; Prior et al., 1983)	Normed on 496 3- to 6-year-olds. Item coverage is limited to hostile-aggressive, anxious, and hyperactive/distractible behaviors. Test-retest reliability ranged from .60 to .94, and interrater reliability was .67 to .84.

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